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1975 / 77
Agriculture & Rural Development
Vol. II

RETURN TO BANK ADMIN. &
POLICY FILES

FORM NO. 635
(6–77)

CLOSE – OUT SHEET

This file is closed as of Feb 30, 1976.

For further correspondence, please see Vol. III.

RECORDS MANAGEMENT SECTION

Agriculture & Rural Dev

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Suite 1200 • 1430 K Street, N.W. • Washington, D.C. 20005
Ray Fitzgerald, *President* ▪ Bartlett Harvey, *Vice President*

February 25, 1976

Mr. Robert McNamara
President
International Bank for Reconstruction and
Development
1818 H Street, N.W.
Washington, D. C. 20433

Dear Mr. McNamara:

The Small Farmer Credit Committee is an ad hoc group of interested professionals from, but not representing, U.S. and international agencies, which for some years has been investigating various aspects of the problem of channeling institutional credit to small farmers in developing countries. For a while the focus in this area was on the AID Spring Review of the same question, but recently with the help of Development Program Grant funds provided by AID to Agricultural Cooperative Development International, the Committee has resumed active work on the problem.

In an attempt to build on the work of the Spring Review, the Committee agreed that ACDI should engage a consultant to review the relevant literature and interview Committee members and other appropriate staff of represented agencies, with a view to culling consensus guidelines for the effective provision of credit on a viable basis to small farmers in developing countries. Dr. Samuel Daines, formerly a program economist with the Ford Foundation and US/AID, was commissioned to do this. Copy of this report in two volumes is attached, together with a brief compilation of his conclusions.

Dr. Daines produced both an excellent analysis of the economic problems involved in raising the incomes of small farmers and an extensive bibliography of the relevant literature. However, he concludes that "Despite a substantial literature on small farmer credit, the amount known (about the relative merits of alternative delivery systems) is disappointingly inadequate to draw consistent directions for program design." And "The conclusion of this report is that

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field measurement must be undertaken for many alternative credit channels before 'guidelines' that really guide can be written."

While the members of the Committee do not associate themselves with all aspects of Dr. Daines' report, we do commend those conclusions to your attention. We believe that extensive field measurement of the impact of alternative institutional approaches to increasing small farmer incomes, including credit delivery systems, is needed for assessing their cost/benefit effectiveness for rural development. We welcome the research efforts already undertaken to this end, such as the AID-financed comparative analysis of 36 rural development projects by Development Alternatives Inc., and the increasing provision for evaluation studies by AID and the IBRD.

We suggest that in addition your agency give serious consideration to the frequent inclusion in rural development projects of provision for a proper study, based on interviews of a random sample of client farmers and a comparable non-client control group, of production, yields, use of inputs, prices obtained, stocks, equipment, income and other relevant factors, at the beginning of the project, periodically during its course and some time after its conclusion. Such studies, which would cost only a very small percentage of typical project totals, would be invaluable aids to project execution and would, in the course of relatively few years, build a base for really solid comparative cost/benefit analyses of alternative approaches to small farmer development. In our view the cost of such studies is an appropriate charge to development administration and research, if project grant funds are not available.

In order that this study be reviewed we have included a summary reference document.

In closing, I want to thank you for the participation on this Committee of Mr. Pierre Courbois. While it has not taken much of his time, his contributions have been useful

to the Committee effort and hopefully he has found the exchange of ideas with other members useful in his work.

Sincerely yours,

John M. Eklund
Chairman
Small Farmers Credit Committee

Enclosures:

Small Farmer Credit Study - Daines No. I
" " " " " No. II
Conclusions of Daines Study

JME:egw

CONCLUSIONS OF DAINES' REPORT ON SMALL CREDIT AND RURAL POVERTY IN DEVELOPING COUNTRIES

I. Extensive field measurement of the impact of alternative institutional approaches on small farmer incomes is needed before "guidelines" for institutional approaches to small farmer credit can be written.

pp 5,6 There are three sets of objectives relevant to the problem:

1. Final small farmer impact objectives; net income improvement, employment, nutrition, increase in farm production.

2. intermediate process or constraint-removing objectives: transportation and marketing infrastructure, product or input prices, more credit, technological information, etc.

3. institution building objectives: rural capital market structures, technical assistance systems, cooperative and farmer group organizations, research entities, supply and marketing organizations, etc.

p. 6 There is decreasing consensus in literature and practice about these: little disagreement about the first set; increasing confusion about what are the critical constraints to achieving them; and almost complete disagreement about the efficiency of alternative institutional forms for making intermediate process changes.

p 18 In essence both IBRD and AID have said that though they are not insensitive to institutional form, yet given the current lack of a reasonable basis for selection no preference can be indicated.

p 44 There is no consensus on the question of which delivery system is best.

p 2 Despite a substantial literature on small farmer credit, the amount known is disappointingly inadequate to draw consistent directions for program design, both in quantity and quality of analytical approaches.

p 3 The conclusion of this report is that field measurement of farm level impacts and institutional costs must be undertaken for many alternative credit channels before "guidelines" that really guide can be written.

p 45 Institutional evaluation would focus, not on the organization itself, but on the performance changes in the farmers it serves: the farm level impacts of programs on income, output, and employment; measurement of total overhead costs, and number of farmers reached. Such a measurement would provide the best possible evaluation measure; dollars of income improvement per dollar of institutional cost.

p 10 In evaluating results, what should be measured is the increase in farm incomes, not program-related proxies for it. Only when such measurements have been made in a variety of countries and for programs using different procedural and institutional mechanisms will rational selection of credit channels and procedures be possible.

p 11 The same farm survey used to measure impact on income will serve well in tracking the production impact.

p 45 No apparent studies are underway to provide quantified, institutional cost/effectiveness analysis of alternative channels for small farmer credit.

II. Alternative small farmer credit delivery systems have shown mixed results or worse, or have been little tried.

p 46 - 7 Commercial banking structures have almost universally been inadequate and inefficient in their provision of credit to the small holder.

p 48 (except in the Philippines and South Vietnam where public incentives overcame the cited difficulties).

p 48 Not only has the commercial banking structure been unable to serve a useful function in this regard, but the available evidence is that they are the worst institutional location to focus future efforts as well. Market, institutional and cultural factors all argue against them.

p 50 The (AID Spring Review of Small Farmer Credit) country papers and an abundance of other literature show that little more than a handful of the several hundred

co-operatives that have been attempted in developing countries have been successful. (1) (M. Miracle).

p 50 Logic seems to favor this alternative, but what little is known of performance is less than encouraging. This would argue for analysis of the farmer impact of co-operatives programs, and the comparative costs of the provision of credit through co-operatives vs. other alternative channels.

p 51 Rural institutions which function as groups take a tremendous amount of energy to originate and keep functioning. Unless the evidence is strongly in favor of their success potential, the added effort may not justify the costs.

p 52 In most cases the public agricultural bank has ignored the really small farmer for the same reasons as commercial banks.

p 54 One of the largest problems associated with the provision of small farmer credit is the immense number of clients who must be reached. To reach them involves the establishment of correspondingly immense institutional structures with wide geographic dispersion. The establishment and maintenance costs of these systems is the origin of a large portion of the costs and failure rates of small farmer credit.

p 54 Input sellers and product purchasers with whom the small farmer already has ties are a logical alternative - provided credit can be made available through them on terms, including risk sharing, that will be attractive to them; and with sufficiently careful administrative controls to guard against exploitation of the farmer.

p 56 ditto money lenders.

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(1) I take substantial exception to this reference from Miracle for two reasons (a) no definition of cooperatives (level of organization, cooperative type, etc.) was referred to, or any identification of "success" and (b) the facts are that, depending on definition, there has been a far greater number of successful cooperatives in developing countries.

[Eklund]

III. In the interests of expanding credit availability and improving investment quality, small farmer credit programs should charge interest rates which cover full cost.

p 57 The literature on interest rates is by now at the stage of majority consensus that subsidized rates are no bargain for the small farmer.

IV. The problem is not small farmer irrationality or inefficiency but the smallness of his enterprise and his lack of access to information, supplies, markets, credit.

p 7 There is now general agreement on Schulz' hypothesis that small farmers are economic men whose decisions are guided by common economic principles.

p 8 Small farm agriculture is generally more efficient. The small farmer is more productive than the large, i.e. has higher output (value added) divided by land or capital or socially costed labor.

p 9 His problem is that he is small, not that he is inefficient. The apparent conflict between equity and efficiency can be set aside as an important issue.

p 22 If the small farmer and the economic processes he is using in miniature are the most efficient, then the principal explanation of his poverty lies in the scale of his operation, and the main avenue of solution lies in changes which will alter his economic environment and allow for an expansion of his efficient processes.

p 21 If the problem is viewed as essentially a question of farmer ignorance and inefficiency, the solution and institutional form would be quite different from a solution based on a conception of the small farmer as an intelligent and rational economic decision maker... allocating his limited resources in very nearly optimal fashion. There is general consensus among economists that the latter is the case.

V. The key problem is to expand the small farm enterprise by creating the conditions under which available unemployed labor can be productively used.

p 19 The characteristic which most distinguishes the small farmer, the implications of which permeate all of his economic alternatives and production processes, is the extremely high labor/land ratio.

p 19 In most areas the small farmer has between 600 and 1200 man days per arable hectare of labor to absorb.

p 15 The largest single technical problem of the small farmer is not what combination of fertilizers and seed will give best results, but what mixture of labor and other factors can be found to increase farm production using labor proportions high enough to make all the available days productive ones.

VI. Credit can assist the expansion of the farm enterprise in a variety of ways, of which increasing the yield of existing basic crops has least potential, and improving the crop mix and the functioning of the farm as a multiple production system the greatest.

p 13 14 Change in on-farm technology is one among many sets of alternative ways of increasing farmer incomes. Small farmer credit programs should look at all and not just the technology subset.

p 27 The potential of yield increasing technical change is very limited:

1. The crops for which viable packages exist are low value crops with little long run potential for raising small farm incomes to satisfactory levels.

2. The historical success at achieving adoption is very disappointing among small farmers.

3. The yield increasing technological packages are applicable to a very limited number of crops and to physical conditions which are not characteristic of small farm agriculture.

p 29 Focus on cereal crop yields should continue to be part of small farmer credit programs, but only to the degree that other alternatives are unable to productively

absorb credit funds and personnel resources.

p 31 In small farm credit programs the dimensions of land slack in the 1-5 HA category should be measured. If there is slack the first farm level production priority should be to finance bringing that land into production.

p 32 The most obvious of all small farmer solutions is to make the small farm physically larger. This should be a focus of small farm credit programs, as well as of land reform.

p 34 Small farm credit could and should be used to finance land transfers; short term credit for rental and leasing, and long term for purchase.

p 35 Each small farmer credit program should take an inventory of the areas in which small farmer multiple cropping is physically and climatically possible. If there are possibilities of the financing of multiple crops in intensive short cycles, including basic grains, it should be done.

p 35 Where perennials are financed, formation year interplanting, and where possible, production year interplanting should be seriously explored for supplemental financing.

p 36 Whatever may be the measurement criteria (gross or net income, input volumes, output volumes, man days required, financing or management magnitudes) changing crop mix will cause more change than any of the alternatives (more intensive land use, higher yields, etc.) we have mentioned.

p 42 The role of credit in supporting or inducing change to a higher value crop mix is, in the long run, its most important contribution to small farmer income.

p 42 Whether credit can induce small farmers to change to higher value mix of crops is an open issue with evidence and opinions on both sides. There is little room for controversy over the fact that credit would be a necessary, if not wholly sufficient, condition to change.

p 42 Processing and marketing industries play a vital role in the small farmer shift to high value crops....

The influence is so strong that the financing of food processing industries in small farmer geographic areas should be considered as priority small farmer credit activities in their own right.

p 35 How individual parts of the small farm production system fit together, seasonally, spacially, and financially, is really more important than the performance of the component activity itself.... This tightness is caused in large part by land scarcity. The analysis of what credit should be used for must include careful farm system analysis, judged more on the overall achievement of the interactive system than any of its parts.

p 36 In such an interrelated system, the farmer not being able to fit one part into the puzzle from lack of liquidity may cause significant distortions in other parts of his microeconomic system.

(The implication of this line of argument combined with the acceptance of the economic efficiency of small farmers would be to favor the farm plan, and disfavor the simple commodity program, as the basis for small farm credit).

BH:egw

Agric + Rural Dev.

Mr. Raymond D. H. Rowe, Agriculture and Rural Development

February 25, 1976

Andrew J. Ewing, Industrial Projects Dept.

Bank Policy on Forestry
First In-House Review

1. I have read your draft "Bank Policy on Forestry". I think that in general, it gives a balanced view of the world forestry situation. I also agree with the priorities you assign to forestry projects for Bank consideration.

2. As I mentioned to you, however, the links between the forest industry, the Bank's activities in this sector, and your proposals for future strategy are not perfectly clear to me. Unfortunately I am not sure that there are any such links.

3. I have attached a list of rather minor arithmetical and editorial comments, referenced by page number.

4. I will attempt in the next few days, to revise your Table 5 on page 9 so that I, at least, can understand it.

Attachment
AJEwing:igc

cc: Mr. Dewey
Mr. Oberdorfer

Attachment 1
List of Minor Comments

Pages i and 2	I believe you dismiss too lightly the potential of North America to provide future needs.
Page 4	Table 2 - shows no pine plantations in the US which is clearly not true.
Page 6	Pulp and paper consumption has not grown by 90 percent in the decade 1960-1970, but more like 60 percent. Also here, and elsewhere, why not use more up-to-date statistics?
Page 7	World paper production adds to 102 percent without even considering all countries!
Page 9	Some of the labor input figures appear to be in error. I find it difficult to relate the "added value" and "gross value" columns.
Page 10	Economies of scale are significant in sawmilling panel industries; but not nearly as much as in pulp and paper.
Page 11	Why five times the man-power in ten years? Output is only going up about 70 percent or so.
Page 15	Confusion between price and value indices.
Page 16	Relative competitiveness study was between new mills in temperate regions (not expansions) and new mills in tropical countries.
Page 25	Footnote refers to what?
Page 27	is there a "satisfactory" management "systems" for the lowland Dipterocarp forests of Asia?
Page 37	the "pipeline" sentence with .....5 fold..... 50 percent reduction ..... 125% increase ..... doesn't seem to make arithmetic sense to me.

Agriculture + Rural

Ted Davis

February 24, 1976

Alan Berg

Improving the Definition and Measurement of Poverty Levels

1. In addition to the earlier comments expressed about the original Keare draft, following are several random thoughts that have since come to mind that you may want to take into account once you receive a revised version.

2. In looking more closely at the Keare draft, it strikes me that the discrepancy between the costs of (1) the all-cereal diet of 2,210 calories a day and (2) the typical diet of the 20% group is much larger than it should be (Page 6). The typical diet figures come from Table 2 of the attachment which, to my mind, is highly unrepresentative of the diets of the poor on the Subcontinent. According to these figures, the poor spend a little over 10% of their food expenditures on cereals; in fact, they probably spend at least 50% and maybe closer to 60%.

3. I would hope that if the nutrition level route is taken as an index of poverty, the measurement be based not on minimum requirements, but on recommended allowances. The former provides enough to keep people alive; the latter not only saves lives, but permits people to work productively.

4. In subsistence economies, one would probably have to consider the size of land holdings, i.e., how much land will be required to meet the recommended food needs?

5. I hesitate to devote more time to this at this stage until we see what Doug Keare comes up with. Perhaps then, if you think it appropriate, we can talk about desirable approaches and ways to refine them for quantification by economic missions.

CC: Mr. Christoffersen
Mr. Venkitaramanan

ABerg/che

General Records

(R.C. 492-17)

INTERNATIONAL DEVELOPMENT ASSOCIATION | INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT | INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

DISBURSEMENTS re: PROCEDURES MANUAL

TO: Mr. Horst von Oppenfeld

DATE: February 23, 1976

FROM: Josef Duester

SUBJECT: Statement of Expenditure Procedure in Agricultural Credit Projects

1. In agricultural credit projects, the "Statement of Expenditure" procedure under Procedure I is frequently used, when credit or loan proceeds are disbursed in the form of numerous subloans, where it would not be appropriate or possible to send a copy of each subloan agreement to the Bank. In these cases, it may happen that the amount of the individual subloan is not disbursed in cash but in kind in the form of fertilizer, seeds, pesticides, equipment, etc. Payment is then made at a date which may be a considerable time after subloan disbursement by the Borrower or the Borrower's agency to the supplier of the commodities delivered under the subloans.

2. If the Borrower is allowed to claim reimbursement after the subloan agreement has been signed and the commodities described in the subloan agreement have been delivered to the Subborrower, the Form Procedure I, Annex VIII, "Statement of Expenditure" should not be used. The Form for these cases could be named "Statement of Subloans Disbursed" to contain both subloans in kind and in cash.

3. The subsequent inspection of the Borrower's accounts would have to verify whether:

-subloan agreements are actually executed and the commodities covered by them are delivered to the Subborrower; and

-payments of the commodities covered by the subloan agreements are made by the Borrower or the Borrower's agency to the suppliers.

JDuester: EC

Agriculture & Rural Development

Mr. R.D.H. Rowe

February 20, 1976

Graham F. Donaldson GFD

Bank Policy on Forestry - Comments on Draft Report

1. This report contains a great deal of useful and interesting information relating to the Forestry sector. However, it is at present a background paper rather than a policy paper. This is true both in terms of the weight of material in the document and in the way it is presented.

2. To improve on the existing draft it ought, in my view, be recast and restructured perhaps along the lines suggested in the attachment hereto. I think that most of the material that would be required in a recast version is already there, but it is much in need of focussing in terms of issues. What is required is far more than an editing job.

3. The present gist of the paper is to justify a forest industry rather than indicate the role of forestry in development and how this role may be realised. In this respect, even more of the material from the "Draper Paper" might be used in this document.

4. In particular, the descriptive material in chapter 1 should go to an annex - perhaps as a foreword to the present annex tables. This would leave three basic chapters which could be re-molded as suggested above.

5. Bill Cuddihy has also read this report at my request and will forward his comments separately.

cc: G. Darnell
C. Bruce

GFDonaldson:mt

Agriculture

Mr.C.P.R. Nottidge,
Agriculture & Rural Development

February 20, 1976

Bernard M. Woods, Training Officer, EDPDR

Notes on Rural Training Centers

As requested I attach some notes of important points to consider when planning rural training centers. These notes have been compiled hastily to meet your departure deadline and are not exhaustive. If I could be of assistance in providing more detailed information on any aspect touched upon in these notes, please let me know.

BMWoods/jdg

cleared with and cc: Chittleburgh
cc: Ballantine

NOTES ON RURAL TRAINING CENTERS

INTRODUCTION

Rural training centers (both residential and day centers) offer a means of providing intensive extension training to support and strengthen extension programs, and a well managed center can achieve a very great impact on the community it serves. However, residential training centers are expensive to operate and require efficient management, good communication with field extension services and skilful teaching, if they are to justify the investment in them.

The greatest value of a residential training center is its flexibility of use. It can be used for training courses for farmers, extension staff, community leaders, cooperatives' staff and teachers; for training in support of women's nutrition, child care and family life programs, and as a venue for seminars and meetings of farmers associations and youth clubs, as well as for many other purposes. Most rural training centers are planned and staffed primarily for the training of farmers, but the greatest return from the training activities at the center will probably be from 'indirect farmer training' i.e. the training of people who will be able to influence, or pass on the training to, more members of the rural communities than the training center itself could accommodate. Thus, much of the center's time and effort should be devoted to the training of local leaders, farmer group representatives, extension agents, teachers and women's leaders, and centers should be planned and staffed with this in mind.

Set out below are some important points to be considered when planning rural training centers. These are derived from experience of the operation of such centers in a number of different countries.

I. RESIDENTIAL CENTERS

To justify the investment in accommodation, catering facilities and full-time staff for a residential center, a minimum residential capacity of 40 is needed. In most situations a training center should be able to handle two courses concurrently, in which case a minimum residential capacity of 60 will be needed.

1. Siting

The center should be sited:

- close to the headquarters of the area served so that senior extension staff and subject matter specialists can easily assist with teaching;
- easily accessible from the main access roads to the area served;
- outside a town rather than in one, and where electrcity, telephone and water supply can be provided, and
- on soil reasonably typical of the area served.

2. Staffing

Teaching Staff should include:

- a principal who would be responsible for all the instruction given at the center;

- two or more agricultural instructors - depending upon the size of the center and the amount of teaching assistance available to it from outside;

- one instructress in home economics and nutrition, who would also be responsible for the catering at the center.

Courses taught at the center should cover a wide range of agricultural topics. Trainees coming to the center will be made up almost entirely of adults, many of whom will have low levels of education and literacy. To be effective, therefore, the teaching must be dynamic, skilful, and relevant to the trainees' experience. Very often training centers become staffed by individuals who have shown ability in field extension work, but who have had no training in the techniques needed in a 'formal' instruction situation. The success of the center will depend upon the quality of the teaching, and simple training of the center's teaching staff in basic teaching methods, lesson planning and the use of visual aids, is a very worthwhile investment.

Administrative Staff

The principal of the center will be responsible for the planning and teaching of all the courses; for communication with the extension service; contact with leaders of the community served by the center, and for the center's overall welfare. He should not be encumbered by the day-to-day administrative chores of running the center - this should be handled by an administrative officer. The administrator should have training and experience in accounting and storekeeping and should be responsible for all the center's records; ordering, receiving and issuing of stores and foodstuffs; farm and rainfall records, and the handling of cash. Depending upon the size of the center, the administrator may need to be assisted by a clerk/typist.

3. Facilities

(a) Teaching

Two classrooms to accommodate 40 each, one of these adaptable for the teaching of home-craft and nutrition subjects.

Recommended seating: benches and narrow tables.

In addition, a "demonstration farm lab" has proved useful. This would comprise a covered area with tiered seating and sufficient space between blackboard and seats to allow implements and machinery, animals, or plants to be brought in and demonstrated to the class.

(b) Dining/Kitchen

Hall to accommodate 100 (this can become a local meeting point and a service to the community). Tables and stackable chairs are recommended. The hall and a classroom should be designed to permit film projection.

The kitchen (adjoining the hall) should be designed to cater for numbers in excess of the total residential capacity of the center because, if the center is well managed and becomes popular, day courses are likely to be held in addition to the residential courses.

Two kitchen stores should be provided:

- a bulk food store; and

- a daily issue store.

Kitchen staff work long hours and their comfort should be considered. Ablution facilities for kitchen staff need to be provided.

In most circumstances, electricity or bottled gas have proved best for cooking purposes.

(c) Accommodation

The maximum flexibility is needed to facilitate courses to be run with different numbers of men and women. Several separate blocks are recommended, each containing six to ten double rooms with each block having its own ablution facilities. Each room should contain two beds (steel rather than wood); two cupboards; and space for suitcases.

(d) Administration

Three offices are needed for: principal/administrator/teaching staff. A storeroom should be provided for teaching materials, vis/aids, etc.

(e) Housing

The principal, the administrator and the officer responsible for catering should all be housed at the center. It is desirable that other teaching staff should also be housed, but this will depend upon local availability of alternative housing.

(f) Demonstration Land

The center should have sufficient land attached to it to enable the demonstration of as wide a range as possible of the different

enterprises which are being recommended to farmers in the area served by the center. The more agricultural services which can be sited at, or in the vicinity of, the center the better e.g. bull station, milk collecting center, machinery servicing and instruction point, forestry nursery, etc.

4. Layout of Facilities

Widely spaced buildings will result in high costs of upkeep of grounds. In laying out the buildings it should be remembered that the administration and kitchen/storage will receive most traffic, and access to these buildings should not disturb teaching activities.

5. Transport

Transport is likely to be the center's largest single item of recurrent cost. A sturdy bus will be required to transport participants to and from courses and on field trips during courses. In addition, the center will need a second vehicle in order to buy foodstuffs and for staff to use when holding short courses away from the center - a light pick-up is a suitable vehicle for this purpose.

6. Length of Farmers' Courses

Few farmers can be away from home for long periods and, if fees are charged, the cost of long courses will be a disincentive - however good the teaching. In most circumstances, short courses will have the greatest impact i.e. those of two days' to one week's duration. These courses should be on clearly defined topics, containing a few positive recommendations of immediate application to the farmers' situation, together with some necessary background information. Farmers who find a course useful and interesting will be likely to return to the center for further training.

7. Fees

Arguments exist both for and against the charging of fees. Some believe that farmers should contribute to the cost of their training and will value training more if fees are charged; others maintain that the disincentive of fees, particularly to the poorer members of the farming community, (who generally are the ones most in need of training) is so great that fees should not be charged. The decision on whether fees are to be charged to farmers is a matter to be settled between local authorities and community leaders.

8. Relationship with the Extension Services

The training center should be an integral part of the extension service, and the instruction given at the center to extension staff and farmers should be in support of specific extension programs. The training

activities of the center and quality of the training courses should be the concern of the extension officer in charge of the region, district or area served by the center.

9. Relationship with Community

A danger exists of the training at rural centers having little relevance to local farming needs. It is important that local people feel that the center is of value to them, that they can visit the center freely, and exert an influence over its activities. It is equally important that the teaching staff of the center have regular opportunities of leaving the center to keep themselves abreast of conditions and needs in the field. The following will help to make the teaching more practical and relevant: (i) assigning responsibility to the center for the solving of extension problems in the immediate vicinity of the center, and encouraging teaching staff to visit farmers around the center; (ii) encouraging leading local farmers to participate in the teaching of courses; (iii) attaching mobile training units to the center.

10. Mobile Units

The effectiveness of a residential center and the efficiency of the utilization of its teaching staff can be greatly increased by attaching to it a mobile unit which would be used to provide short, single-subject training courses at day centers or villages throughout the area they serve.

The nature of the mobile unit will vary according to the size of the area to be covered and the manner in which it is to be used: if it is to travel out daily from the research center carrying simple teaching aids, and will only spend an occasional night in the field, a light covered pick-up will suffice. If it is to cover a large area and spend whole weeks away from the center, a more robust vehicle equipped with slide and film projection equipment would be justified.

A mobile unit should be regarded as an extension of the residential center, and all teaching staff of the center should have regular opportunities of travelling out into the field with the unit. Clearly the addition of a mobile unit to a residential center will necessitate an increase in the number of teaching staff at the center.

The mobile unit should be used as an extension support tool to provide intensive extension as needed by specific campaigns. Programs of work for the unit should be agreed between the district or area extension supervisor and the principal of the residential center. However, while in the field, the daily activities of the unit should fall under the direction of the extension supervisor.

II DAY CENTERS

The day center should provide a simple facility to which people living in the immediate area can come for one-day courses and return home the same day. The courses would be conducted by extension staff, subject matter specialists, and staff of mobile units from a 'parent' residential training center.

Day centers will not require permanent staff (other than a watchman). If possible they should be sited close to some other facility e.g. extension office, demonstration site, extension agent's house or research sub-station.

1. Relationship with Community

The more that local people can identify themselves with the center the more effective it is likely to become. Therefore, in establishing the center, local people's views on the need for the center and its siting should be sought. Ideally it should be established in a building made available by the community or in a building which the people helped to construct.

2. Facilities

Buildings can be very simply constructed of locally available materials, and should include:

(a) Classroom to accommodate 40;

(b) office (lockable) in which teaching aids etc, can be kept;

(c) semi-covered area with water supply provided which can be used for teaching of simple nutrition and food preparation, and where midday meals brought by participants can be prepared and utensils washed;

(d) toilets - preferably dry type.

(e) Demonstration Area: a small area of land should be attached to the center where simple demonstrations of crops and husbandry practices can be maintained by the local extension agent.

(f) The day center will not require any permanent transport.

3. Operation

District or area extension supervisors should be responsible for planning the use of day centers within their areas in support of their extension programs. They should be responsible for enlisting the assistance of a mobile unit from the 'parent' training center or expertise from headquarters, research stations or commercial suppliers, in the running of their courses. They might be helped with the planning of these courses by an extension training specialist from headquarters. In addition, day centers may be used for regular short in-service training of local extension staff.

Further Reading

For more comprehensive information in the planning and operation of rural training centers see:

Barwell, C.W. Training for Agriculture : Farmer Training in East, Central and Southern Africa, Rome, FAO 1975

Bradfield, D.J. Guide to Extension Training, Rome, FAO 1966

Engberg, L . Courses for wives at farm institutes and rural training centers. Rome, FAO 1966.

BMWoods/jdg

WORLD BANK / INTERNATIONAL FINANCE CORPORATION

Agriculture & Rural Dev

OFFICE MEMORANDUM

TO: Mr. R. D. Rowe

DATE: February 20, 1976

FROM: Bill Cuddihy

SUBJECT: Bank Policy Paper - Forestry - Comments on Draft

1. This paper provides an excellent background to forestry. Resources, both existing and required; markets, industries and institutions are discussed. Issues and constraints are highlighted in view of the increasing interest in forest renewal in LDC's. The paper does, however, leave me with some unanswered questions which may be due to my misreading the paper or to my unfamiliarity with the state of the art of forestry economics.

2. The overall policy objective of the Bank is to promote economic development howsoever defined. Does forestry help develop an economy and how well? Would scarce resources used limit development by other means both with regard to land use competition and capital? How well does forestry perform compared to agriculture and what parameters are to be used for measurement? Chapter 2 gives a brief description of forestry as a tool of economic development but provides no analytical treatment. For instance, plantation forestry is said to be labor intensive requiring, "40-50 man days/ha over 2 or 3 years for plantation establishment". Since this occurs once per rotation, this has to be annualized and added to maintenance and harvesting labor requirements. The annual requirements should then be compared with requirements for agriculture or any other alternative if they exist. Also, one has to look at time distribution of labor. Employment may be generated on a worthwhile scale at planting and harvesting, but what happens in between?

3. How is forestry to be integrated into a rational land use program given the present need for rehabilitation of marginal lands in many LDC's and the certainty of more to come? What are the alternative tree farming activities that can be chosen for different purposes - for instance, village operated fuelwood blocks to increase the income (consumption) of the lower 40% versus government plantations for foreign exchange to achieve growth objectives? I would like to see an analysis of the comparative worth of the alternatives in terms of policy objectives. Also I would like to see a breakdown of the objectives of forestry policy.

4. Another troublesome point relates to price policy and Bank leverage - as mooted for irrigation water charges. What should the Bank's involvement be in the pricing of forest products in view of the totally distorted market price mechanism? In all parts of the world land has been cleared for dairying or cropping which should have been left under forestry. Millions of dollars are spent annually on regrowth control and erosion prevention to try to keep these lands in farming, whereas these same resources plus the forestry income could do more for real development with less engineering ingenuity. Why does agricultural man try so hard to crop farm and graze where he could tree farm with ease? This choice as determined by the market place is rational. For him the only relevant decision criteria are short-term private financial benefits - i.e. money in his pocket now. For economic development the criteria are long-term public economic benefits subject to the usual financial and distribution considerations. Should the Bank have a forestry pricing policy to close this divergence?

continued ...

5. Does the Bank regard forestry as a separate sector competing with agriculture for resources or as a sub-sector complementary to and interwoven with agriculture?

6. A real problem when discussing forestry as a tool for economic development is the methodology for measurement of its performance. Annex 19 gives various rates of return for different projects. I am sure more of the variance is due to haphazard shadow-pricing than to differences in productivity. Further, in the absence of even a vague approximation of a free market, social profitability as determined by traditional methods leaves me unsatisfied. For the same type of project in the same area - fuelwood in the Sahel - rates of return are shown variously as minus 200% and plus 20% depending on the skill of the analyst in shadow-pricing.

7. The occasion of a policy paper on forestry seems to be an admirable time for grappling with these problems:

1. What are the specific policy objectives?

2. How to include empirical and analytical data to judge the performance of forestry in achieving them?

3. How does forestry fit into a basic resource development program and not simply a forestry development program?

4. Should the Bank have a forestry products pricing policy?

WCuddihy:oh

Agriculture & Rural Dev

Mr. R. D. H. Rowe

February 20, 1976

Antonio Tarnawiecki

Bank Policy on Forestry (Draft)

1. The first draft sent by you for my comments is a very good effort to cover an important field which, until recently, as pointed out in the referenced draft, has been treated in the Bank on an ad-hoc basis. Several minor comments, questions and corrections are written on the margins of the draft being returned to you. Some more substantial comments follow.

2. I do not agree with the establishment of worldwide priorities as shown in pages iii and iv of the Summary and Conclusions and pp 38/39 of Chapter IV. Priorities should be established on a country-by-country basis taking into consideration all the factors involved. For instance, it is perfectly conceivable that for a given country development of an export-oriented market pulp industry (a third-priority project according to the draft) should have a higher priority than an import substitution project (which would have a second-priority classification).

3. Many production, consumption and trade tables contain information for years 1960 and 1970 but no more recent data, such as those for 1973 which have already been published in the FAO Yearbook.

4. Chemical pulp requirements are discussed on pages 16/18 but no clear separation of the world needs for long and short fiber market chemical pulp is made. I think the conclusions would be much clearer if an introductory paragraph is added briefly describing the qualities, end uses and main statistics of these two types of pulp. The potential for production of market pulp in the developing countries could then follow.

5. The possibility of an eventual loss of future availability of genetic resources could be mentioned in page 23 as one the dangers inherent in uncontrolled forest exploitation.

6. On page 28, another objective for forest management that could be added is: Rural development projects which create conditions for permanent agricultural land/instead of shifting cultivation.

use

ATarnawiecki:km

cc: Messrs. Fuchs
Dewey/Perram
Oberdorfer/Ewing

Agriculture

February 13, 1976

Mr. Frank D. Aigner
Agricultural Economist
Farm Credit Administration
Washington D.C. 20578

Dear Mr. Aigner:

I am referring to our conversation yesterday, after the ACDI meeting, about the information I would like to obtain from the Farm Credit Administration.

As I mentioned to you and Mr. Robert J. Hewett, Sr., I am engaged in a study on the cost of distribution of agricultural credit, including costs of raising resources, administration costs, and costs resulting from defaults.

While the study is concerned with credit agencies which are, or might be, financed by the World Bank and, to the extent possible, mostly with credit to small farmers, I have also gathered information on the cost of distribution of credit in developed countries for comparison purposes. I have not yet any information on the various agencies of the Farm Credit Administration (and FHA), and I would appreciate if you could help me fill the gap. I would also be very grateful if you could provide me with some general update documentation on the activities (raising of resources and lendings) and financial position of the various agencies of the FCA (which is usually given in annual reports).

Yours sincerely,

PC

P.A. Courbois
Agricultural Credit Adviser
Agriculture and Rural Development
Department

Agriculture + Rural Dev

Mr. Ted J. Davis

February 12, 1976

A.M.S. Ahmad

Draft Paper on Monitoring and Evaluation in Rural Development Projects

1. It is necessary to have definitions of the terms "monitoring" and "evaluation" so as to avoid confusion in using these terms interchangeably for various types of activities. The definition as given in para 1.3 might lead to such a confusion. I suggest that for monitoring and evaluation we should list the purposes and mechanisms to achieve the purposes and then divide the objectives and mechanisms under the definitions of monitoring and evaluation.

2. In my opinion, the purposes of monitoring should be implementation, supervision and control of a project. Mechanisms for these would involve:

i) laying down of specific functions and responsibilities at various levels of management -- who does what, when and how;

ii) specification of information needed for (i) above including system for collection, collation and timing of reporting;

iii) specification of actions at various levels of management on information submitted to them under (ii) above and the use by them of such information; this would include problem solving and investigations into problems to determine actions required for meeting specific difficulties into which a project might have run into;

iv) data generation -- specification of data to be collected with clear exposition of the purpose for which data is required and what use would be made of the data collected;

v) collection of data which are needed for evaluation and which can most conveniently be collected during implementation of a project. Data collected under this type of activity should in addition assist the project management to keep a watch on the projected impact of the project.

3. At the policy level, monitoring reports fro m project management should indicate:

i) progress of implementation in the context of projected performance;

ii) problems that were encountered in course of implementation and actions taken to overcome them;

iii) nature of actions required from policymakers, either to prevent recurrence of such problems or in solving problems still unresolved;

iv) information on the impact of the project in relation to its projected objectives.

4. Information of the above category should enable the policymakers to:

i) make changes and additions to policy and procedures for more effective implementation;

ii) undertake similar other projects and/or develop complementary projects;

iii) provide guidance for evaluation studies.

5. The purpose of evaluation should be:

i) to assess whether the objectives/benefits outlined for the project are being, or have been achieved;

ii) to assess operation/organization and cost/benefit aspects of the project with a view to making recommendations on their suitability and adequacy for similar projects;

iii) to re-assess/re-evaluate the basis on which the project was formulated with particular emphasis on areas to which attention should have been focused;

iv) lessons that could be learnt from the implementation of the project with regard to: a) project implementation; b) project management, c) supplemental studies which are essential before similar projects are undertaken in the future; and d) actions which could have improved performance and benefits, such as: training, stricter supervision, more timely identification of problems and timely actions to meet them, more effective policy and procedural support from the policymakers.

6. Monitoring and evaluation are increasingly forming integral components of Rural Development projects. While it is difficult to outline the details of an evaluation study of a project* it should not be difficult to draw up a plan for monitoring a project. A monitoring plan should be in the nature of a critical-path chart showing the various components of the project, the responsibilities and timing for action of each, so that the project implementation can move smoothly. Monitoring is a management tool and should be specifically responsible to the project management. It should be the responsibility of project management to keep the Government and the Bank informed of the manner in which the project is being implemented. The items on which the management should report to the Government has, in broad outline, been mentioned above.

---

* simultaneously with project preparation

Evaluation, on the other hand, having a more intensive look at the project and having wider implications and time horizon should be independent of project management and should be responsible to the Government in order to assist the Government in formulating policies with regard to similar projects.

7. The paper has recommended the following action:

i) formulation of Terms of Reference for monitoring and evaluation activities (page 7, (i));

ii) documentation to provide guidance on points to be covered in setting up monitoring and evaluation exercises (pages 8 (iii) and 17);

iii) a paper on principles of questionnaire design, sample survey design and analytical procedures (pages 9 (vi) and 22 para 9.1);

iv) project documentation to incorporate monitoring and evaluation. (page 10, para 2.4); This is deemed inappropriate in view of evaluation and monitoring being considered only in the context of Rural Development projects. As suggested earlier, it is important that there should at least be a plan for monitoring of a project during its lifetime. It should not be difficult to have an Annex on this issue on all Rural Development projects;

v) occasional courses and seminars on monitoring and evaluation (page 23, para 9.2).

I agree with these recommendations.

AMSAhmad:vmg

AGRIC. & RURAL DEV.

WORLD BANK / INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: Mr. M. Yudelman

DATE: February 11, 1977

FROM: G. F. Donaldson G.F.D.

SUBJECT: Farm Technology Issues Paper - Working Level Review

✓- DOCS

1. Attached is the first complete draft of the said Farm Technology Issues Paper. A working level review meeting will be held on:

Wednesday, February 16, 1977
at 2:00 pm
in Room D-556

2. Comments are invited from all interested parties, and it is hoped that the members of the "peer group" in particular will be able to be present. Written comments and marked up copies of the draft will be much appreciated (if received by that date). A formal Staff Level Review will be organized for the week beginning February 28, 1977.

3. The paper is organized in three main sections - dealing respectively with precepts, practice and prescription. It is emphasized that this is an "issues" paper rather than a "policy" paper. Thus we are not attempting to formalize accepted practice or agreed changes in practice (nor to rationalize proposed or recent changes). Rather, the purpose is to explain issues and problems that are perceived or encountered in our development efforts with a view to focussing attention on and seeking responses to them. Thus the paper might be expected to read somewhat differently than some of the "policy papers" we have produced in the past.

cc and cleared: C. Bruce CB

cc:
G. Darnell
L. Christoffersen
D. Turnham
T. Davis
Belai Abai
S. Allison
M. Cernea
C. Collins
W. Cuddihy
A. Egbert
J. Edgerton
J. Fransen
J. Goering
J. Graves
F. Hotes
H. Kim
D. Pickering
W. Spall
J. Spears
D. Stoops
D. Sutherland
G. Temple
M. Veraart
M. Lejeune
J. Coulter
D. Ritchie
S Burki
C. Downing
S. Gafsi
J. P. Gittinger
O. Grimes
C. Weiss
P. Hazell
M. Leiserson
F. Lethem
I. Peprah
P. Scandizzo
I. J. Singh

✓ Agriculture & Rural Dev
a Transportation & Urban Dev.

Mr. de Azcarate

February 11, 1976

Johan de Leede

"Workshop on Rural/urban Labor market interactions"

1. The purpose of the workshop was to see in what direction the Bank could best develop its research program on labor market related questions and what cooperation with other researchers in this field would be beneficial.

2. During the discussions, the invited experts showed very little concensus on most fundamental questions such as:

- is migration beneficial for the individual (expected versus realized income; higher money income versus loss of non-monetary advantages);
- is migration beneficial for the economy (differences between wages and marginal productivity; cost of rural and urban unemployment; brain drain of country side; social costs of larger towns);
- is migration beneficial for income distribution.

On all of these questions opposing views can be developed under specific sets of assumptions.

3. During the last session two dramatically opposed conclusions were drawn from the discussions. The first argument presented by Keith Griffin of ILO, went along the following lines:

- the Bank is interested in solving poverty problems. The discussions of this workshop have revealed that experts come to opposite conclusions about the welfare effects of migration. Probably the effects of migration on hard-core poverty are negligible. In most cases migration will boil down to not more than reshuffling of poverty. The Bank should therefore not go on this side track but attack reasons for poverty head-on. Reasons for poverty are in bad distribution of productive assets (for Griffin, mainly land, others include education, for example).

The second opinion had two variances one mainly represented by Schulz (Yale) and the other by Little:

- the Bank has to find ways to improve resource allocation in developing countries.

  Schulz: Through the Bank's economic work the Bank has an impact on the economic policies of its member countries. The Bank should, therefore, be able to advise our member countries on the best allocation of labor resources. Migration is part of this complex. The Bank should help to test the different hypothesis with econometric work and find out which hypothesis are relevant and which are irrelevant.

Little: The only real leverage the Bank has is through lending for capital investments and consequently, on capital allocation. To improve the quality of our judgements we should further develop shadow pricing techniques. A profound understanding of migration is required to arrive at the right shadow price of labor.

4. Participants to the workshop who are directly involved in research projects on migration declared to have benefitted from the discussions and agreed to bundle the individual efforts in some form with help from the Bank. However, emphasis was put on the advanced stage of some of the research projects and the undesirability of "straight jacketing" of researchers.

5. The concerted testing of hypothesis will be done by collecting and processing data on wages (or income), employment (or participation) and institutional factors. After the last session a special meeting was arranged for the researchers to determine points of common action.

JdeLeede:mjk

Agriculture & Rural Development

F244

Mr. G. F. Donaldson

February 11, 1976

G. P. Temple GPT

Workshop on Rural-Urban Labor Market Interactions

1. I attended the entire first day and part of the second day of the Workshop (February 5, 6, and 7). An exception to the general restatement of conventional wisdom was the Harris-Sabot paper on the role of "search" activities in migration. The model focuses on the relationship of the dispersion in wage offers, levels of unemployment, expectations and extended social systems on migration.

2. An interesting view raised by Baghwati is: "How does a social system adapt to the existence of surplus labor?"

3. There was great confusion about three important issues: the informal sector, efficient use of agricultural labor and the determinants of migration.

4. The "murky" or "informal sector" provides employment for 50 to 80 percent of the urban labor force and perhaps even a greater proportion of the rural labor force in LDC's. Because little is known about this sector, I am convinced that we need empirical research on its laws of production and distribution. Specifically, we need to know what mechanisms determine technical coefficients, allocate employment rights, and determine the levels of remuneration to labor. As the title of the Workshop indicates, many economists are convinced that these important economic variables are determined in "the labor market", the neo-classical theory which is well known. In many LDC's, however, the type of technology used, the quantity of labor employed and the distribution of value added in production may be independent of any factor market. Our division ought to research these issues so that projects aimed at increasing the production and income of rural labor can be better designed and more easily implemented.

5. Economists at the Workshop were convinced that inefficient allocation of labor occurs if the remuneration of labor exceeds its marginal product. Efficiency can be achieved even if daily incomes exceed daily marginal productivity, provided that the marginal product of labor is equalized across all activities.

6. Many participants expressed a desire for better information on the determinants of migration. It is an interesting topic but ought not to be given attention by our division because the information would have littler influence at any point in the project cycle.

GPTemple:oh

Agriculture

Mr. C. Applewhite CGFPI

D.C. Pickering Agric + Rural

February 10, 1976

Document I: Status of Seed Industry in Developing Countries and its Investment Requirements (Document FP1/76/1-10)

1. I have just read the above paper with considerable interest. Unfortunately Table 4, page 17, is incorrect in a number of respects. A revised version based on recent World Bank Group data is attached hereto.

2. You may wish to bring this information to the attention of delegates. Further, please note that para 52 of the paper should indicate the World Bank Group is financing a seed project (our oldest in fact) in India.

DCPickering:hrv

cc: Mr. M. Yudelman Agree

Attachment

Table 4: ESTIMATED COSTS OF SEED PROJECTS FINANCED WITH THE PARTICIPATION OF THE WORLD BANK GROUP

Country	Total Costs	World Bank Financing	Local Financing
	(U.S. $ million)		
India I (Tarai)[1/]	22.4	13.0	9.4
Indonesia[1/]	21.0	7.5	13.5
South Korea[1/]	35.0	7.0	28.0
Bangladesh[1/]	19.2	7.5	11.7
Ecuador[2/]	5.0	3.0	2.0
Pakistan[2/ 3/]	56.5	23.0	33.5
India II[2/ 3/]	55.0	30.0	25.0
India III[3/]	45.0	25.0	20.0
Malaysia[3/]	7.5	3.6	3.9
Burma[3/]	8.0	5.0	3.0

1/ Project being implemented.
2/ Project being processed.
3/ Preliminary estimates.

Source: World Bank Group

✓ Agriculture & Rural Development —
cc Li - W.M.O

Mr. Charles Weiss

February 9, 1976

G.F. Darnell

Use of Meteorological and Hydrological Data in the Preparation and Execution of Bank Projects

1. With reference to your memorandum of January 29, the following comments are submitted from the viewpoint of the Agriculture and Rural Development Department, CPS. They represent an agglomeration of the views of staff members in the Department who received a copy of Dr. Parthasarathy's paper.

2. The consensus is that the report is potentially useful overall if only because it focuses on an aspect of vital importance to many of our projects, and an aspect which non-technicians have been known to down play, if not overlook. However, a number of the conclusions and recommendations are very loosely framed and appear to us to be neither fully justified nor entirely appropriate. Our comments are referenced to the paragraphs in the summary; absence of comment signifies agreement.

3. Para 3.2. We do not fully agree with the opening sentence. This is hardly surprising, since it reflects the basic difference of approach between the staff of an investment/development institution (the Bank) and a primarily science oriented organization (WMO). The problem here is to define the term "adequacy of data". Obviously this is a matter of judgment, dependent on project considerations and on the experience of the personnel concerned. Safety factors have to take account of judgments on the adequacy of data in relation to the estimated costs and benefits deriving from project structures. Our rainfed agricultural and rural development projects are increasingly being sited in areas with limited climatological data. Although project design and the investment decision must still be dependent, inter alia, on judgments in respect of climatic factors, the adequacy of data to support such judgment gives some cause for concern. However, see para 9 below, we believe that more data could be made available to project identification, preparation, and appraisal staff.

4. Para 3.3. Although important, we do not agree that the margin of safety is the single most important reason for the success of Bank water-using projects to date. This is far too simplistic a view, at least insofar as agriculture/irrigation projects are concerned.

5. Paras 4.1/4.2. These are very loose recommendations. In its projects and sector work the Bank encourages countries to expand their agro-climatic, yield and production data collection facilities when such is felt to be needed. Funds have been and should continue to be lent in appropriate circumstances for this purpose. However, the major impetus for this type of promotion should surely come from organizations such as WMO and FAO?

6. Para 4.3. We have problems with this recommendation. First, we wonder if our organization is competent to advise developing nations to undertake the experiments recommended. Surely in a specialist area such as this, WMO is the institution best placed to take the lead? Second, and of considerable apparent importance, with the developed nations currently spending millions of dollars in this field, and with relatively little to show for their efforts at present, we wonder if the prior call on the limited resources of the developing nations should not be for more directly productive pursuits. Research of the kind envisaged in this recommendation appears better suited to bilateral funding with inputs from both recipient and donor countries and a major technical input from WMO.

7. Para 4.4. We agree that the Bank should endorse such programs. Their initiation would appear to be the responsibility of governments with the advice and support of WMO, perhaps in association with FAO.

8. Paras 4.5/4.6. We agree that the Bank should continue to provide encouragement for such surveys. Where appropriate and when governments can be persuaded to borrow funds for the purpose, the Bank should continue to incorporate activities of this kind within its projects. Incidentally, is the author fully aware that Bank funds are lent to its customers, i.e. not granted?

9. Cooperation with WMO. We agree with the general drift, that the Bank could probably use WMO more effectively than it does at present. Certainly there seems to be a need for wider distribution in the Bank and elsewhere of such WMO development oriented agroclimatic and hydrological data as are available. The trouble is that no one seems to be quite sure what WMO has to offer. The compilation and distribution of country and/or regional agro climatological and hydrological reports on a regular basis to member countries and within the Bank has been suggested as one means of spreading the word. We feel that this approach, of a wider dissemination of WMO data, would be preferable to the proposals in paras 4.8.2 and 4.8.3 for Bank/WMO consultation on specific projects. Whilst not wanting to close the door completely, the general feeling is that our technical staff are competent to make judgments on the climatological/hydrological factors bearing on the feasibility of most of our projects. However, when warranted, we should certainly continue our practice of drawing on WMO expertise, as happened for example in the appraisal of the India, Drought Prone Areas Project.

10. Finally, we do not agree that there is need for a cooperative program with WMO. Although our contacts with that institution could profitably be increased, we do not consider that such should be sought via a cooperative program. Formalizing our relations in this way would be administratively cumbersome and inordinately expensive in terms of manpower and other resources.

DCPickering:hrv

cc: Messrs. Yudelman, Allison, Hotes, Kanchanalak

✓ Agric + Rural Dev.
cc Education

Mr. John Simmons, Development Economics — February 6, 1976

Bernard M. Woods, Training Officer, EDPDR

Draft Section of a Study on Chinese Education

I feel that a lot could be learned from Chinese successes in rural development activities which would be useful and applicable to situations in LDC's. I also feel that everyone working to promote rural development should be aware of these successes, and so I see an immediate application for your study. However, as we discussed over lunch, a primary target for this information should be field management staff involved in rural development efforts, and the following comments are made with this in mind.

1. In each case study there appear to be two separate elements - each containing different lessons. There is the technical example (e.g. agricultural training, or new teaching methods) and there is the background political situation. In reading the case studies, and not being very familiar with the practicalities of the Chinese system, I found references to the political background distracting. This political situation contains important lessons in community involvement and commitment - as evidenced in the descriptions of TACHAI, and references to political awareness, and actions of villages and party committees in influencing policy.

I wonder if it would be possible to extract from the text references to the political situation (e.g. the "struggle against the bourgeois tendency", and "the peasant revolutionary struggle to consolidate the dictatorship of the proletariat") and include an introductory chapter describing the political structure in greater detail, and stressing peasants' participation and commitment to policy decisions. The case studies would then be read against this background which might make easier reading.

2. As an introduction to each case study, a brief summary might be useful of items which have contributed to the particular success of the case. Examples from the agricultural training case study which would have relevance to staff and farmer training in most LDC's could be summarized as follows:

(a) The movement of the training institution out of the city.

(b) The training of extension workers must expose the trainees to farmers and farmers' problems, and part of their training should be to participate in finding solutions to those farmers' problems.

(c) A program aimed at making teaching more relevant to prevailing rural conditions must start by convincing the teachers of this need and providing them with training on how to adjust their teaching so that it is better identified with local examples and conditions.

(d) All forms of training institutions for rural development workers can be used to help solve local problems by means of trials, demonstrations, surveys etc. Involvement of training institutions in these activities will improve the quality of the teaching and enhance the standing of the institutions in local opinion.

(e) The involvement of successful farmers in the teaching program will help to identify the teaching with local problems and solutions.

(f) Community leaders should be encouraged to communicate with training institutions and request assistance from these institutions in solving their local agricultural problems.

If a discussion of any of the points raised above would be of use I would be very happy to participate.

BMWoods/jdg

cc: M.Hultin

Agric + Rural

All Agriculture & Rural Development Division Chiefs February 4, 1976

Ted J. Davis, Head, Rural Operations Review and Support Unit, CPS

Meeting to Discuss Draft Paper on Monitoring and Evaluation in Rural Development Projects and Formulation of Future Work Program Aimed Toward the Development of Guidelines for Setting up Monitoring and Evaluation Mechanisms.

A draft paper analyzing the past and current situation relating to monitoring and evaluation on rural development projects has been prepared by Dennis Anderson as a joint CPS/DPS effort. The Assistant Directors have previously received copies of this paper and in many cases have already circulated it to Division Chiefs. For your convenience I am attaching an additional copy.

A meeting will be held on Thursday, February 12, at 3 P.M. in Room D-860, to discuss this paper and the plan of work as recommended by the paper. We have already received comments from Division Chiefs in East Asia and Pacific regions. It would be helpful if others who wish to comment in writing could do so by February 10. Some Regions and some Divisions have designated specific individuals to be primarily concerned with the problems of monitoring and evaluation. Hopefully, these individuals will attend along with any others designated by you.

cc: Messrs. Baum
Chenery
Karaosmanoglu
van der Tak
Israel
Yudelman
Darnell
Willoughby
Dulhati/Avramovic
Christoffersen
Turnham
Bruce
Leisersen
Anderson

Thru your P.to P.

INTERNATIONAL DEVELOPMENT ASSOCIATION | INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT | INTERNATIONAL FINANCE CORPORATION

✓ Agriculture & Rural

OFFICE MEMORANDUM cc Li - FAO

TO: Mr. Clark

DATE: February 4, 1976

FROM: Shirley Boskey SB

B.U. Feb 9.

SUBJECT: Meeting on Food (February 9)

Warren Baum, who is organizing the meeting on food to be held in Mr. McNamara's office at 1:30 on February 9, to which you have kindly agreed to go in my stead, told me that one question in which there may be some interest is the extent of FAO's mandate, i.e., not what it may wish to arrogate to itself but what it is now authorized to do.

With that in mind, I have taken a look at the FAO constitution (that is what it is called) as adopted in 1945. I suppose the point of interest is whether there is anything in it which contemplates that FAO would be a financial institution, or a channel for investment in food projects.

The constitution gives FAO the following specific functions:

1. To collect, analyze, interpret and disseminate information, relating to nutrition, food and agriculture.

2. To promote and recommend national and international action with respect to (a) scientific, technological, social and economic research relating to nutrition, food and agriculture; (b) improvement of education and administration relating to nutrition, food and agriculture and the spread of public knowledge of nutritional and agricultural science and practice; (c) conservation of natural resources and adoption of improved methods of agricultural production; (d) improvement of processing, marketing and distribution of food and agricultural products; (e) adoption of policies for provision of adequate agricultural credit; and (f) adoption of international policies with respect to agricultural commodity arrangements.

3. To furnish technical assistance to governments on request.

4. To organize missions needed to assist governments to carry out recommendations of the FAO Conference which they have accepted and to take all necessary and appropriate action to implement the purposes set out in the preamble of the Constitution, i.e., to raise levels of nutrition and standards of living, improve efficiency of production and distribution of food and agricultural products and better the condition of rural populations.

There is no explicit reference to agricultural investment, although it could be argued that this is authorized under the "necessary and appropriate" catch-all language.

A quick check has been made of amendments to the Constitution through 1971, the conclusion being that none of these refers to agricultural investment. There may have been some amendments since 1971 for which the text is not readily available. If a definitive answer to this question were required, more work would have to be done. I would suggest that we wait to see what points are raised at the meeting on Monday.

Agriculture
YELLOW central - Files

February 3, 1976

Mr. E. B. Rice

George F. Darnell

Second Annual PPA Review: Comments on the Agriculture Set

1. Your memorandum to Mr. Bohr on this subject has provoked a number of comments from regional staff and advisers in this department.

2. There is general agreement that mixed feelings are in order concerning the need for more preparation. However, the suggestion that better preparation would have aided the Kenya Smallholder Credit project is not accepted. On the contrary, the project was held to be prepared as well as it could have been under the circumstances; further preparation would have been a waste of time.

3. Thoughts on preparation are that the extent of and time spent in preparation must be a matter of judgment. Judgment is needed as to whether the data base is strong enough to support appraisal or whether additional studies, and hence delays are essential. My hunch is that experience will increasingly tend to show that, particularly, rainfed smallholder production projects have been under-prepared. I believe that there should be a much stronger insistence on the provision of basic data on project areas than is presently the case. A certain amount of climatic, soil, demographic and relevant socio-economic information must be available at appraisal, the precise amount of each being project specific. However, in no case should we be prepared to appraise projects for which, for example, there are no rainfall amount and distribution records pertaining to the proposed location, or for which no information is available on the amount, distribution and general characteristics of the major soil types, or for which family size and age distribution is not known. On the other hand, if it is considered essential to insist on, say, an additional five or ten years of rainfall records, before appraisal, it is obvious that the project as conceived is not appropriate for the area and no further project specific preparation work is warranted.

4. Your observations on improved start-up procedures drew mixed reactions, the strongest being that delays were occasioned by failures on the part of the governments concerned. In the Kenya Credit case, Africanization was proceeding rapidly, experienced expatriate staff were leaving with consequent deleterious effects on start-up.

5. There was some objection to the statement concerning strengthening management and institutions that the institution building problem involved insufficient attention and commitment on the part of the Bank. More importantly however, I think the emphasis conveyed is incorrect. Thus, while it is important that the Bank pays attention and commits itself to institution building (IB), it is absolutely imperative that governments should be fully convinced and committed, not merely "convinced too". Unless the question of

IB has been fully explored with a government, and preferably been initiated by the government in the course of preparation and appraisal, results are very likely to be less than hoped for.

6. Your observations in paragraph 9 elicited the response that in livestock credit projects the potential borrowers are unknown at appraisal. The number of them likely to come forward depends largely on a frequently changeable financial and economic climate and the attractiveness of the loan conditions. For these reasons, estimations of physical investments are bound to be difficult and can rarely be regarded as more than illustrative.

7. The remarks on financial accounting in paragraph 15, while probably true in many cases, are inaccurate insofar as they refer to the Kenya Tea II project. Rather than very poor financial accounting, arrangements in this project were extremely good. One observation arising from your comments on this subject was to the effect that, in general, OED reports tended to treat accounting and auditing rather superficially.

8. Objection was taken to the implication that staff training in the Kenya Tea Project was not good. The evidence indicates otherwise i.e. a very rapid transfer of management responsibilities to a staff that is now totally Kenyan. A point of general importance here is that apparent inaccuracies or overly sweeping generalizations by OED are dangerous because of the damage they do to that department's credibility.

9. Several views were expressed on the question of breached covenants. Paragraph 22 appeared to imply that failure to react to breaches in covenants was a universally "bad thing". Experience in one Region has been that some covenants turn out in practice to be less critical than others, and it is not inevitably calamitous if a breach of some covenant is overlooked. What this really boils down to is that failure to maintain covenants must be judged in the context of the impact of a covenant and the seriousness of failing to carry it out. This will differ from case to case within projects as well as among projects. It was agreed that there are many cases of breached covenants, particularly in respect of submission of reports, accounting, auditing and interest rate levels. It was felt that they should highlighted in OED reports for the benefit of management and Executive Directors. One suggestion worth a thought was to investigate why the Bank has failed to react, or how it has reacted to such breaches. There certainly seem to be occasions when the risk of jeopardizing country/Bank relations is used as an excuse for avoiding firm, and necessary action on broken covenants.

cc: Messrs. Yudelman
Claessaner
Handry
Courbois
Fransen
Kotas
Pickering

DKPickering/am

agriculture

Mr. M. Burney

February 3, 1976

George Darnell

Comment on Annex 4, "Food Production and Distribution", Club of Rome draft

1. We have no basic disagreements with the major thrust of this paper but would not necessarily agree with all of the points therein. We believe there is merit in the general organization of the paper, viz., looking at the world food problem and possible solutions from short, medium and long-term points of view. However, like most drafts, considerable tightening up of the argument and editing are required.

2. Among those points to which we would not fully subscribe is that relating to the need for altered consumption habits among the affluent countries. There is merit to the general point and believe the point is well worth making but question whether a meat excise tax or meat rationing are likely to be politically acceptable or workable.

3. Other minor points which we believe require further clarification or reconsideration:

(a) Page 4-1, para. 2. While existing food supplies may be theoretically adequate to meet effective demand in the world, nutritional requirements are not being met and this should be mentioned here.

(b) Table 1 as it relates to nutrient intake in LDCs implies a precision in the figures which doesn't exist. Also, reference years should be indicated.

(c) Page 4-2, first full para. It seems necessary to quantify the claim on world food which consumption patterns in the developed countries are making on agricultural resources. What portion of the world's coarse grain production goes into livestock production?

(d) Page 4-3, second full para. The widely-quoted figures on number of days' food reserves are highly questionable. These figures vary from week to week as harvests are taken in throughout the world. They also ignore food in the form of livestock and livestock products - important sources in many countries.

(e) Page 4-4, second full para. It might be questioned whether an increase in food prices in general has an adverse impact on national welfare. A major production constraint in many countries is inadequate price incentives to producers and some increase in food and farm prices is likely to serve the long-term national interest.

(f) Page 4-5, second full para. There may be instances in which a world fertilizer pool and reserved production for LDCs have merit. However, we believe the proposal deserves careful study, particularly as it relates to possible adverse effects on private sector investment incentives.

(g) Page 4-10, paras. two and three. We would take a somewhat more generous view of the effects of the Green Revolution. The statement that its "initial impulse" has "petered out" because of the narrowness of its research base might be questioned. Certainly an important factor was the expansion to marginal lands where benefits were less attractive or farmers less able to utilize this technology for lack of the requisite complementary inputs. The "impact" in South Asia is a matter of judgement. One study estimates that in 1972/73 some 30 m. ha of crop land in Asia were planted to HYVs and resulted in increased wheat and rice output by 18% and 7%, respectively during that crop year.

(h) Page 4-11, second full para. We consider it useful to mention urgent research needs in the management of tropical soils. Also, some recognition should be given to the expanding research program at the international centers.

(i) Page 4-12, first para. The statement "... one unit of fertilizer can go a much longer way in certain developing countries" should be restated to focus explicitly on differential fertilizer response ratios in DCs and LDCs.

(j) Page 4-12, first full para. The argument in support of irrigation and water management needs elaboration. Certainly costs deserve mention as well as benefits.

(k) Page 4-13, first full para. We believe a system of guaranteed price supports frequently exceeds implementation capacity in many countries. Remunerative price levels and price stability are required, but these can be provided by simpler mechanisms than price guarantees.

JGoering:mt

Agriculture
EDD

Agriculture & Rural Development Projects
Division Chiefs
Ted J. Davis, Project Operations Review & Support Unit (RORSU/AGRD)

February 2, 1976

Clarification of Instructions for Submission of PIBs

The Project Information Brief (PIB) System for Agriculture and Rural Development Projects has been operating in its present form since April 30, 1975. It was instituted by a memo from Mr. Baum on that date. In reviewing the progress of the system and because of a considerable number of telephone inquiries from project staff it is apparent that certain clarifications are needed. Areas of confusion are listed and discussed below:

1. Purpose and Scope of PIB

The PIB was the result of the policy established by the Executive Directors in their adoption of the Rural Development Policy Paper wherein the establishment of a monitoring system was called for. This paper states: "The objectives /of the monitoring system/ are to help influence the design of projects at earlier stages in order to increase their impact on the productivity and quality of life for the rural poor, and to follow the progress of projects through the pipeline. This monitoring will be achieved by the filing of regular Project Information Briefs (PIBs) on all projects in the lending program and will result in the system of quarterly progress reports".

2. The Need for Estimates in Completing PIBs

Project staff (all of whom have high standards of professionalism) are naturally reluctant to provide information for which there is little or no basis during early stages in the project cycle. Not withstanding this reluctance, it is the purpose of the PIB to focus on the expected aims of the project and for this purpose estimates are needed. For example, Item 12, relating to number of farm families benefitting from the project; Item 13, economic benefits to farm families; and Item 14, incremental employment impact, are subjects even "ball-park" estimates would give a preliminary picture of what the expected aim of the project is at a given time in the cycle. Certainly projects change (especially during appraisal); but, for implementation of policies, the submission of estimates of a project's impact is important in the early stages of project preparation.

3. The Timing of Submission of PIBs

Mr. Baum's memo suggested the submission of a PIB upon return of all project identification, preparation and appraisal missions. This is interpreted to mean the following:

a) making sure that the mission leader and mission members are fully familiar with the PIB form and the instructions on the back of the form, before a mission goes into the field. This can best be done by going over the form during the pre mission briefings and by the attachment of the form to the Terms of Reference for all project missions.

b) by the submission of a completed PIB through the Division Chief to the monitoring unit as an attachment to the Back-to-Office or the Full Report of each mission prior to appraisal;

c) the submission of a completed PIB with all final estimates carefully completed along with the Yellow Cover of each appraisal report;

d) it will be the responsibility of those organizations outside the Bank engaged in project preparation to submit PIBs through the appropriate Division Chiefs within the Bank. This would, of course, include FAO/IBRD CP and the Regional Missions in Africa. Instructions have been sent to these organizations which are included as an important feature of the PIB system. Special arrangements should be made by Division Chiefs where other institutions are engaged in project preparation.

4. Country Poverty Income Levels

There is still some occasional misunderstanding relating to Item 7 on the PIB form which requires country information including poverty levels. As stated on the form this data is to be provided with the assistance of country economists and has been derived by the country economists through estimating absolute poverty based on minimum nutritional and non-nutritional needs and on relative poverty established at 1/3 of per capita total personal income for the country. Country economists have submitted this information on some 75 borrowing countries. Project staff who are in doubt can either contact their country economists directly or may contact me in the Rural Operations Review and Support Unit.

5. The New Bank-wide Experimental Project Brief System

Under Mr. Knapp's memo dated December 16, 1975, the Bank has instituted the new Bank-wide experimental Project Brief System which will be tried for about 1/3 of all projects in each projects division for FY78-79. This new experimental system does not replace the PIB system for Agriculture and Rural Development projects. The Knapp paper states, "Form 1028 would continue to be prepared in accordance with current instruction.... For agriculture and rural development projects selected by Division Chiefs as part of the initial experiment, Section A of Form 1028 would be replaced by the more descriptive PB as outlined in this proposal, and Section B would be annexed to it as a special data sheet."

While there had been problems in establishing the PIB system, a very large majority of project staff are making an effort to help strengthen the system so that it can become a valuable tool at all management levels in the Bank.

cc: Assistant Directors for Agriculture and Rural Development
Messrs. Baum, van der Tak, Yudelman, Christoffersen, Turnham, Ahmad, Cernea, Lindahl, Rhoe, Huyser, FAO/IBRD CP, Creyke, RMEA, Geli, RMWA

Agriculture
+ Rural Dev

Mr. John H. Adler

January 30, 1976

J. Burke Knapp

Country Lending Programs in the Agricultural Sector

In accordance with our telephone conversation today, will you please send me a draft memorandum in response to the memorandum from Mr. Martin, giving him the data on our Agricultural Lending Program for the period 1976-80, together with a statement of how we normally translate commitments on agricultural projects into disbursements thereon.

Please note that I do not propose to give Martin data on our total lending program by countries.

cc: Messrs. Baum
Yudelman

JBK/ag

Agric + Rural Dev.

Mr. R. K. Johanson

January 22, 1976

O. P. Gautam

Comments on the Draft Paper on Monitoring and Evaluation in Rural Development Projects

1. It would be very useful to have the proposed Central Projects Memorandum on the 'Objectives of Project Monitoring and Evaluation' and the paper on 'Techniques of Survey Design and Analysis.' The operational support on technical questions by Central Projects staff during project operation should also be welcome.

2. 'Monitoring' and 'Evaluation' have each two distinct components:

Monitoring:	(a)	base line data through bench mark survey;
	(b)	additional information needed during project operations;
Evaluation:	(a)	audit of project performance and operation;
	(b)	evaluation of project benefits and impact.

These four phases should perhaps be discussed separately in the paper. In the case of education projects, evaluation of benefits can be done only by covering a reasonable (3-5 years) post-project operation period. For this, governments may have to be assisted after the project completion.

3. In addition to enrollments, other indicators such as number of dropouts, number of farmers/farm youth/ farm wives who have received some kind of training should be included under Education response variable (page 18).

O.P. Gautam

OPGautam:bcl

✓ Agriculture & Rural Dev.

INTERNATIONAL DEVELOPMENT ASSOCIATION | INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT | INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: Mr. J. Burke Knapp, Senior Vice President, Operations

DATE: January 16, 1976

FROM: Edwin M. Martin, Chairman, CGFPI

SUBJECT: Bank Group Lending Program, 1976-1980

1. The Consultative Group on Food Production and Investment in Developing Countries (CGFPI), in close collaboration with the Bank and the OECD Secretariat, assembles on a current basis data on investment flows into agriculture.

2. We intend now to add a dimension to this work by also tabulating anticipated medium-term investment flows as projected in the work programs of the major international financing organizations and the DAC countries.

3. We would much appreciate your collaboration in this endeavor; more specifically we would like to receive for the period 1976-1980 on an individual country basis i) the Bank Group's projected total lending, and ii) projected lending volume for the agricultural sector. We fully realize that such information, as it is based on CPP's, can be subject to substantial modifications and that it is to be treated confidentially. We request it for our internal use only.

4. In the event the exercise requires much additional work, we would be glad to make our Research Assistant available for the purpose.

AGRIC. & RURAL DEV.

WORLD BANK / INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: Mr. Mark W. Leiserson, ECDER

DATE: January 13, 1977

FROM: I.J. Singh, ECDER

SUBJECT: Issues Paper on Farm Technology - First Draft

1/- DOCS

1. I have reviewed this paper and made a large number of notations on the margin that I hope will be of some use as the authors asked for them.

2. Although one can agree with the general argument presented that one should take a very broad view of technology and its impacts if one is to provide anything meaningful, the unresolved problem that remains is how to do this. Most people are aware of the fact that technological change is part of an interaction socio-economic-technical complex, the problem is how to go from this awareness (for which one should commend the paper) to specifics. Some attempts at defining the forward and backward linkages and first, second and reverse effects is made but aside from an awareness of the framework, one has also to ask how one would implement this awareness. In this regard, of course, we all have more questions than answers.

3. One can only concur with the statement on p. 13 regarding all the fuzzy thinking about appropriate technology. What is appropriate will depend upon the specifics of time, place, technical, economic and other considerations. One should not a priori rule out any spectrum of techniques in order to pursue the will-o-wisp of "appropriate technology."

4. There is a commendable emphasis on "process" and "dynamics" although again being able to trace out the dynamic impacts is more easily said than done. This is also true of the need to incorporate the social, physical and institutional infrastructure and its relations to technological change. The emphasis allows an awareness that is to be applauded, but how one can incorporate these relationships is not addressed. This is certainly a methodology issue but a real one.

5. There are other comments but these are incorporated in my marginal notes.

R.C. 492-121

WORLD BANK / INTERNATIONAL FINANCE CORPORATION PUBLIC JOURNAL DEP.

OFFICE MEMORANDUM

TO: Those Listed Below

DATE: January 11, 1977

FROM: G. F. Donaldson G.F.D.

SUBJECT: Issues Paper on Farm Technology - First Draft

✓ - DOCS

1. Attached is an outline of this Paper - together with a draft of Chapter I. We would appreciate your comments (preferably in the form of marginal notes) on this by c.o.b. Friday, January 14, 1977.

2. The Paper is planned to have three sections, dealing respectively with precepts, practice and prescription. The first chapter is therefore conceptual in nature while the subsequent ones can be expected to be more operational in their content.

3. It should be kept in mind that the Paper is an "issues paper" in contrast to a "policy paper". Thus we are not attempting to formalize accepted practice or agreed changes in practice (nor to rationalize proposed or recent changes). Rather, the purpose is to explain issues and problems that are perceived or encountered in our development efforts with a view to focussing attention on and seeking responses to them. Thus the Paper might be expected to read somewhat differently than some of the "policy papers" we have produced in the past.

4. A draft of Chapter II should be circulated within a week, and of Chapter III soon after that.

5. A Working Level Review is proposed for Monday, January 31, 1977 at 2:30 pm in Room D-560.

cc: M. Yudelman
G. Darnell
C. Bruce
D. Pickering
M. Leiserson
D. Turnham
R. Hofmeister
D. Dapice

WORLD BANK / INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: Assistant Directors for Agriculture and Rural Development

DATE: January 8, 1976

FROM: Leif E. Christoffersen, Asst. Director, Rural Development Department

SUBJECT: Rural Operations Review and Support Unit - Renaming and Expansion of Responsibilities of the Rural Development Monitoring Unit of Agriculture and Rural Development Department of CPS

1. The Rural Development Monitoring Unit, created last year, is being renamed and reorganized as the Rural Operations Review and Support Unit, to more fully reflect its functional responsibilities. This will also put it on a more parallel status with a similar unit in the Transportation & Urban Projects Department. I have discussed this with Mr. King and Mr. T. Ruth who both agree.

2. The Rural Operations Review and Support Unit will have the following responsibilities:

a) Assistance to agriculture and rural development project missions through the provision of staff, when available, and advisory assistance through recommending consultants and providing pre-mission briefings when requested. The assistance role will focus on those problems relating to target group impact, multi-sectoral problems, institutional arrangements and cultural and social aspects of project work.

b) The continuation of the monitoring system through the use of PIBs, their analysis and the filing of quarterly reports relating to the pipeline of agriculture and rural development projects in the Bank.

c) The review of all project documentation relating to rural development projects with particular concern for the target group impact and multi-sectoral aspects of projects.

d) The development of guidelines and recommendations for project specific evaluation mechanisms for agriculture and rural development projects to generate, for project management and the Bank, data and analysis of projects during the development period.

e) The preparation of relevant discussion papers and seminars for Bank staff relating to rural development within the Bank.

3. Ted Davis will continue to head the unit under its new name and with its expanded responsibilities and will report directly to me.

Cleared with and cc: Mr. Yudelman

cc: Messrs. Baum
J. King
T. Ruth
Agriculture and Rural Development Division Chiefs

TDavis/cdc

WORLD BANK / INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: Messrs. Mahbub ul Haq and M. Yudelman

DATE: January 7, 1976.

FROM: J. B. Hendry

SUBJECT: Comments on "Functional Review of the Treatment of Agricultural Prices in Bank Economic and Sector Reports"

Comments were requested on the collection of papers subsumed under the title shown above. These include (a) a report entitled "Review of Agricultural Price and Subsidy Policy Issues in World Bank Country Economic and Sector Reports" prepared by DPS; (b) six annexes containing excerpts from recent country economic and agricultural sector reports which deal with agricultural price and subsidy issues; (c) a report entitled "Functional Review of the Treatment of Agricultural Pricing in Bank Group Economic and Sector Reports - Progress Report" prepared by CPS.

I confess I have not read this very carefully to examine whether specific points were consistent or fully accurate, but I have read with sufficient attention to assure myself that there is disappointingly little of immediate value to those in the Regions concerned with improving the quality of economic reporting or sector work. The recommendations offered on page 28 seem sensible enough, calling for missions to examine agricultural pricing policies more fully, to make better use of available raw material in the form of project-derived data, and establishing a general framework for the analysis issues. This is followed by completely acceptable, but not very innovative, list of issues to be considered in formulating a general framework for analysis. What is not discussed is whether this work should be done at the expense of other activities now included in the economic reporting sector work, who should set the priorities for such revisions in the allocation of manpower for reports, or whether this is important enough to call for additional manpower from some place. Nothing new is advanced to indicate how our analysis might be improved in qualitative ways, aside from the usual disclaimer that what is actually done will vary from country to country and from time to time. These recommendations are followed by suggestions concerning additional research that ought to be done on pricing and subsidy issues. Once again these are an interesting group of suggestions, but there is no effort to arrange them in any set of priorities, or to indicate how much of this total package ought to be done or commissioned by the Bank. In their present form they can be of little use other than perhaps a shopping list. In this context, it is surprising to find no mention of the Zambia Agriculture Price (ZAP) project which is being conducted by DRC. This was specifically commissioned by the Eastern Africa Region, the purpose was worked out jointly, and it has been received very enthusiastically by the Zambian authorities. The objective of this exercise was to provide the Region with a basis for operational discussion (not generalities) on appropriate pricing decisions in agriculture.

I have no particular comments on the annexes, other than to note that the excerpt from the Kenya Economic Report dealing with agricultural price issues was reviewed in the draft stages by people in our department.

The CPS contribution consists of classifying, by types, the pricing systems followed by member countries of the Bank. This is descriptive and not very interesting, and not very informative either since it does not add to what must be intuitively obvious to those working in agriculture. There follows a further section which introduces a quantified analysis of pricing issues as these are handled in Bank reports. Here we find such information as this -- only half the reports provide any idea on the effects of an output price management system; credit is treated in only forty two of fifty reports examined, and so on. We are not informed whether a perfect score on such an analysis is 100 percent, but it does seem to me that this adding up of responses on particular points is a singularly uninformative way of going through Bank work. The section dealing with the recommendations found in Bank reports confirms what is widely known, i.e., that Bank staff tend to prefer free market solutions to price-setting or subsidy arrangements in agriculture.

I would not want the remarks above to be interpreted as a criticism of the people who have worked on these reports, because they have probably done a conscientious job within the guidelines provided for them. What does bother me is the fact that so much manpower has been directed into topics which, by their very nature, are likely to produce these kinds of general and useless reports. I don't know who actually benefits from them, and will concede that possibly someone will be educated in some way, but I am quite certain in my own mind that this type of thing is of no help to the Regions. That conclusion is compounded when one adds in the amount of time which is required for the review and commenting on these reports. My annoyance in this instance is probably heightened by the fact that a roundtable discussion was recently held by the Region to determine the type and extent of additional work which would be required to cover the new emphasis to be placed on population problems in economic and sector work and CPPs. There again, additional work by the Regions was being urged without reference to relative priorities or the manpower implications.

I attach a memo prepared by Mr. Krishna which deals with the same subject.

Attach.

cc: Messrs. Wapenhans, Adler, Hablutzel
Goffin, Haynes, Rowe, van Gigch, Vergin
Walden, Walton, Krishna

JBHendry:of

WORLD BANK / INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: Mr. J. B. Hendry DATE: January 7, 1977

FROM: K. G. V. Krishna

SUBJECT: Comments on "Functional Review of the Treatment of Agricultural Prices in Bank Economic and Sector Reports"

1. I am somewhat ill at ease in commenting on the draft papers by EPRPR and AGPER on the above subject. This is because I am not sure what these papers are expected to achieve. If the intention is to prepare a check-list of items to be covered during an economic/sector mission, the reports are indeed useful, although any economist (agricultural economist) worth his salt should be fully familiar with the items concerned. However, if the objective is to critically examine the coverage of these issues in past Bank economic/sector reports, one would obviously have to examine the practicability of the recommended coverage in terms of manpower availability, financial magnitudes and programming. In this light, the proposals presented in these reports fall in the same category as a number of other perfectly valid suggestions and recommendations coming from CPS/DPS, but which cannot easily be fitted into the work programs or budgetary provisions.

2. The difficulties inherent in analyzing every relevant aspect of pricing policies is recognized to some extent in the EPRPR paper. The lack of analytical tools and techniques, and of data is alluded to, but it is at the same time stated that "these are not valid reasons for not devoting more staff time to an issue of such importance". Speaking for the Eastern Africa Project Department, I feel obliged to observe that we have utilized every occasion available to us - economic missions, sector missions, program loan discussions, and Special Studies - to impress upon governments the importance of proper pricing policies (both for products and inputs), the need to move away from uniform pricing, and the elimination of subsidies which may be counter productive in the longer run. We may not have covered all relevant pricing questions on every occasion, but our primary task has been to persuade governments to devote far more attention to pricing than before. Our advice in this regard has tended, in the absence of analytical tools and techniques, to be based more on intuition and observance of known facts, but we have not hesitated to proffer it. The result of our persistent efforts in this regard have been most encouraging, for example in Kenya, Tanzania, Zambia and even Malawi, where the prevailing official attitude is not to "spoil" farmers by raising the prices of marketable crops.

3. The EPRPR paper lists some possible reasons for not analyzing price policies in economic/sector work (para. 44). None of these appear to have inhibited our own efforts to address pricing questions, within

the prevailing constraints of time and manpower. The growing concern that we were handicapped in proceeding beyond the generality of recommending that governments adopt incentive pricing, because we either lacked data or analytical techniques, led us to take the initiative of proposing, supporting and participating in a DRC Study of this subject. I consider it a major omission that neither of the two draft papers refers to the ongoing DRC Study of the Zambia Agricultural Policy Model, which, from recent accounts, has had an enthusiastic reception in Zambia.

4. The EPRPR's recommendations in para. 49 are sound and fully reflect the concerns we have always had. I do not disagree either with the detailed list of questions listed in para. 50. However, we should be clear that the range of questions listed cannot be covered either by a single mission or on a single occasion. It is most important that the groundwork for price policy discussion is adequately prepared. It may even be necessary to mount special missions to address pricing questions. The efficient coverage of agricultural pricing in the latest Kenya economic report is attributable to (i) the ground having been prepared in prior discussions, (ii) relating the participation of agricultural specialists solely to pricing/marketing/scale of production aspects, and (iii) providing precisely-worded terms of reference to reflect the above. The result was a very satisfactory treatment of these questions, which touched upon technology and income distribution questions as well. It is important, before one is asked to take the EPRPR recommendations seriously, to realize the manpower and financial implications of the kind of coverage that they propose. It is equally important to note that the basic responsibility for undertaking this work must devolve upon Bank staff, (and not consultants who often lack an overview), and hence that its priority must be decided in relation to other demands which compete for their time and, indeed, other vital matters in the agricultural policy field e.g. extension and training, packages, institutional arrangements, research which are at least as important as pricing and should be addressed.

5. While the EPRPR report is interesting and besides provides a useful check-list, the AGPER report suffers from an attempt to quantify its findings, particularly with regard to the failure of economic/sector reports to address specific questions. The question which is relevant is not whether 10 or 15 reports dealt with one-half or one-third of the problems in the countries they covered. Rather, it is whether the reports have properly identified the issues and problems in the pricing area (if such problems exist) and stimulated the interest of government representatives in addressing the relevant questions. It is neither necessary nor even desirable that the principal responsibility for dealing with these questions should devolve on the Bank. On the contrary, the countries should be encouraged and, when feasible, assisted in undertaking some of the tasks.

cc: Messrs. Adler, Walton, Walden, Hablutzel and Ms. Goris

KGVKrishna:cg

Agriculture & Rural

Harcourt Management Corporation

P. O. Box 656
Scarsdale, N. Y. 10583

AREA CODE: 914-SC 3-1254

January 7, 1976

Mr. Robert S. McNamara, President
International Bank for Reconstruction
and Development
1818 H Street N.W.
Washington, D.C. 20433

Dear Mr. McNamara:

There really is no necessity to predict long term food shortages or Malthusian disasters. A solution could well be the net leasing of vacant, arable land to individual, underdeveloped countries.

I am enclosing a brief resume of the concept for the review and creative comment of your organization.

I am at your disposal.

Very truly yours,

HARCOURT MANAGEMENT CORPORATION

Joseph D. Blau
President

JDB/lz
Encl.

Form No. 630
(4–73)

CONFIDENTIAL

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT
INTERNATIONAL DEVELOPMENT ASSOCIATION

AGRICULTURE & RURAL DEV

POLICY REVIEW COMMITTEE

PRC/s/M/76-1

December 31, 1975

ISSUES IN BANK FINANCING OF RURAL PUBLIC WORKS

STAFF REVIEW

√-DOC'S

Attached please find the paper "Issues in Bank Financing of Rural Public Works" prepared by the Development Economics Department. A digest of the Harvard University report on "Public Works Programs in Developing Countries: A Comparative Analysis" is also attached.

A staff review will be held on January 12, 1975 at 10:00 a.m. in Conference Room D-556.

Please inform this office if you cannot attend.

Shahid Javed Burki
Secretary
Policy Review Committee

DISTRIBUTION

Attendance

Messrs. Haq (Chairman)
Avramovic
Blaxall
Chernick
Christoffersen
de Azcarate
de Vries, B.
Dubey
Gilmartin
Hablutzel
Hasan
Hendry
Jaycox
Karaosmanoglu
King
Kuczynski
Picciotto
Please
Pollan
Rowe, R.E.
Turnham
van der Tak
Vergin
Westphal
Yudelman

Copies for Information

IBRD Department Directors
Program Coordinators
Division Chiefs,
Development Economics

Agriculture + Rural Dev.

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(4–73)

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INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT
INTERNATIONAL DEVELOPMENT ASSOCIATION

POLICY REVIEW COMMITTEE

PRC/s/M/76-1

December 31, 1975

ISSUES IN BANK FINANCING OF RURAL PUBLIC WORKS

STAFF REVIEW

Attached please find the paper "Issues in Bank Financing of Rural Public Works" prepared by the Development Economics Department. A digest of the Harvard University report on "Public Works Programs in Developing Countries: A Comparative Analysis" is also attached.

A staff review will be held on January 12, 1975 at 10:00 a.m. in Conference Room D-556.

Please inform this office if you cannot attend.

Shahid Javed Burki
Secretary
Policy Review Committee

DISTRIBUTION

Attendance

Messrs. Haq (Chairman)
Avramovic
Blaxall
Chernick
Christoffersen
de Azcarate
de Vries, B.
Dubey
Gilmartin
Hablutzel
Hasan
Hendry
Jaycox
Karaosmanoglu
King
Kuczynski
Picciotto
Please
Pollan
Rowe, R.E.
Turnham
van der Tak
Vergin
Westphal
Yudelman

Copies for Information

IBRD Department Directors
Program Coordinators
Division Chiefs,
Development Economics

Agric & Rural

Mr. T.J. Davis, Rural Development Division — December 30, 1975

George Kalmanoff, Deputy Director, Industrial Projects Department

Draft Paper on "Small Industries and Rural-Urban Development"

In response to your memorandum of December 9 on the subject, attached are comments by Mr. Thadani, Chief of our Economic and Sectoral Division, which is responsible for this Department's work on small industries.

I agree with Mr. Thadani's suggestion that the draft should be focused to a greater extent if it is to be helpful as an operational instrument for project identification and preparation. It is at present somewhat repetitive and excessively long. And in its attempt to be comprehensive, it cites far too many overlapping examples in the 8 Exhibits to be helpful as a guide to the making of choices. Incidentally, the rationale for having so many Exhibits is not clear, nor are the sources for the Exhibits always indicated.

I also subscribe to Mr. Thadani's point about the draft's glossing over the difficulties of successfully establishing industries in rural environments. If it were merely a matter of deciding on objectives, identifying needs of small industries, and setting up programs to meet these needs, the record of attempts to establish industries in rural environments would not be as fraught with failures as it is. We know far too little about the strategic elements for success to be this blithe about it. Incidentally, the emphasis in the title and frequently in the text on rural-urban industries rather than on rural industries as a component of rural development tends to dilute the focus of the paper, which presumably is on rural development; the references to rural-urban linkages can be retained without such dilution of the focus.

The report should also be sifted for elimination of assertions which appear somewhat vague, questionable, or contradictory. For example, in the Introduction and Summary:

1) with respect to Objectives, how do you get "the poor rather than the traditional entrepreneurial and merchant class "to participate in small industries? is the provision of "goods and services to local consumers" mutually exclusive vis-a-vis producing for "urban or export markets?

2) with respect to Identifying Needs, if, as suggested above, small industries are to produce for local markets, why should their marketing knowledge "of all but very local markets" be improved? as regards appropriate technology, it has frequently been observed in the literature that small industries tend to vehave better than larger industries since they are generally not biased by restrictive labor provisions and they have little access to subsidized capital; what are the "social dimensions" which "are often ignored in designing programs etc."?

3) with respect to the Need for Linkages, how do you time local industries "to provide seasonal employment during the slack seasons in agricultural production cycles" without keeping their capital idle at other times? in the same connection, how do you "time linkages" so as to "enhance the integration of agricultural and non-agricultural activities, with the size, technology and products of local industry transforming over time to meet the changing needs of agricultural and the rural population"? is it desirable for "policy makers" to "decide to reserve certain products for production by small scale industries" by fiat?

In making these suggestions, I am mindful of the fact that the subject of the draft is very challenging and difficult, and I feel that much useful material has been brought together in it. The suggestions are made to the end of tightening of the presentation so as to enhance the value of the draft.

cc: Messrs. Fuchs, Moore, Thadani

CKalmanoff:vlb G.K.

INTERNATIONAL DEVELOPMENT ASSOCIATION | INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT | INTERNATIONAL FINANCE CORPORATION

Commodities
cc Agriculture & Rural Dev.

OFFICE MEMORANDUM

YELLOW COPY

TO: Prof. Maurice Albertson, Consultant

DATE: December 29, 1975

FROM: Wouter Tims, Director
Economic Analysis and Projections Department

SUBJECT: A Study on the Prospects for Irrigation as a Determinant of World Foodgrains Supply - Terms of Reference

The Objective and Scope

1. As agreed, you will undertake an assessment of the global prospects and potential for irrigation, drainage and water control. The assessment will also consider the implications for agricultural production and in particular, for the supply of foodgrains. The study will include:

(a) A summary of actual irrigation and drainage developments since 1950 to the present time;

(b) A brief survey of technological progress in irrigation systems and methods during this period;

(c) Estimates of the area that is potentially irrigable or reclaimable and that area which is likely to be irrigated or reclaimed by 1985. "Likely" should here be construed in the sense of both technical and economic feasibility;

(d) In ascertaining economic feasibility you will provide your judgement, together with that of Bank Staff, as to the likely investment implications of proposed irrigation reclamation schemes and their impact on agricultural production. In this context it is proposed that investment costs be restricted to the irrigation and drainage facilities per se and to the costs of developing on-farm irrigation.

(e) Also, in view of their global importance, some consideration should be given to recent irrigation developments in China and the USSR.

Timetable

2. (a) You will be engaged in the preparation of an initial draft of the report in Fort Collins for an aggregate period of four weeks or twenty working days.

(b) A detailed outline of the study is desired by mid-February; you will subsequently plan to spend two to three days in Washington D.C. in the third week of February to discuss and finalize your approach with the Economic Analysis and Projections Department.

(c) The draft report should be completed towards the middle of March, 1976.

(d) With respect to this study, you should establish contact with the Land and Water Resources Division (Mr. Clyde Houston heads this group) of FAO in Rome and, if possible you may wish to visit with these people on your return from Pakistan.

Cleared with & cc: Mr. Hotes
cc: Mr. Takeuchi
Ms. Hadler

Agric. F321
Rural Roads

Messrs. Bruce, Churchill, Hardy, Harral, Hogg and Malone

December 24, 1975

Curt Carnemark

Steering Committee Rural Roads. Review of First Part of OECD Manual.

1. One of the intentions, as you will remember, with the Steering Committee on Rural Roads was that it act as a panel for review of the work being done by the OECD Working Group on Rural Roads.

2. We have now received the first part of the draft OECD-manual which deals with "the state of the art of rural road planning in developing countries".

3. I would very much appreciate your taking the time to review this document and give me your comments by COB January 6. The OECD group will meet again on January 12 to discuss the work and I would like to carry with me as broad an opinion as possible.

4. Thank you for your cooperation.

Enc.

cc: Messrs. Bovet, Faiz, Hodgkinson, Barham

CCarnemark:mrd

Agriculture

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Mr. Gilbert Brown, Policy Plan. & Program Review December 23, 1975

Shankar Acharya, EAfrica I

Proposed Policy Paper on Agricultural Prices and Subsidies

1. Thank you for sending me the outline of your proposed policy paper for comment. If anyone was agnostic about the importance of agricultural pricing/subsidy issues a glance at your exhaustive outline of its many ramifications should bring him off the fence pretty swiftly. While I am completely persuaded about the policy importance of the subject, I must confess to some doubts about the manner in which you propose to generate the policy paper: via a set of country case studies, with the entire process to be completed (to PRC staff level review) by September.

2. Given the very substantial body of official (including Bank) and academic literature which exists on this subject, I would argue that there are really only two kinds of fresh studies which would be valuable. The first kind of study would be an attempt to fill out your outline through a systematic culling of existing analytical/empirical work, to be conducted ideally by an eminent practitioner in this area, like, say, John Mellor (who, incidentally recently reviewed parts of this literature from a somewhat similar viewpoint in Bank Staff Working Paper No. 214 "Agricultural Price Policy and Income Distribution in Low Income Nations", September 1975). Such a review could provide the basis for a policy paper. The second desirable type of study, I believe, would be very detailed country exercises which try to analytically model the general equilibrium characteristics of the problem (which your outline emphasizes) and come up with operational price policy guides in country-specific contexts. I have in mind the CHAC-type applications in Mexico and the ongoing research project on Agricultural Pricing in East Africa, RPO 329, with which I am peripherally associated.

3. From this vantage point (and it is a personal one) I fear that the case studies you propose fall in between the two categories of desirable studies I have outlined above. Given your September deadline (July/August for first draft?) and the usual programming delays for launching studies, I cannot see how these case studies will do more than add marginally to the already large portfolio of partial equilibrium analyses of agricultural pricing questions. Indeed, the resources spent on them could preempt efforts at systematic review of the existing stock of such work.

4. To put it in a nutshell, I would have preferred a work program which gave more weight to reviewing existing work for the policy paper phase and concentrated the resources for case-studies on one or two solid, longer range studies designed to provide operational country-specific guidance on price policies, rather than spread them thinly over 10 2-4 month reviews of country experience. (All this assumes that you, like everyone else, operate within a limited resource budget!)

cc: Messrs. Please, Hansen, Leiserson

SAcharya/lta

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Agriculture & Rural

OFFICE MEMORANDUM

TO: Mr. R. Picciotto through Mr. K. Pranich DATE: December 17, 1975

FROM: H. T. Chang

SUBJECT: Rural Public Works

The following comments answer the eight questions posed in para 2 of Mr. Gulhati's memo of November 12 on the above subject:

1. Re (i) of Mr. Gulhati's memo we prefer to regard "Rural Public Works" as a broad term applicable to different civil works done in the rural area. Each country or each project would have different needs, such as the construction of feeder roads, embankments, rural markets, godowns, health clinics, living quarters, classrooms, training centers, canals, drains, village ponds, etc. For Bank financing considerations, the four categories listed in para 29 of the draft "Issues in Bank Financing of Rural Public Works" have adequately covered all possible types of works. The operation of health workers, teachers, extension officers, etc. as such should not be a part of the rural public works if the project involves mainly civil works. The civil works, however, can be a part of a health, education or extension project where construction of facilities is needed. In an integrated rural development project, the civil works usually forms a category of the project cost.

2. Re (ii) whether the rural public works can play a major role in the alleviation of poverty and utilization of the labor force depends on the magnitude and continuity of the work program in proportion to the size of the underemployed labor force in the country. The magnitude and continuity of the program depends on Government policy. The US used rural public works to provide employment during the depression years and build long-term resource base. Policy and financial support were given to the CCC camps and soil conservation programs.

3. The main considerations should be:

A. An appropriate trade-off in employing labor intensive methods of construction and the desired quality of work. This is an area where lending agencies and borrowing countries may and do often have different views. It would be useful if the Bank, based on experiences, could develop engineering and economic criteria for determining suitability of adopting labor intensity methods for parts or for whole of different types of public works. Such criteria would be useful for future appraisal.

B. The works will be maintained once they are constructed. This has been a serious problem faced by many Bank financed projects. The lack of maintenance of mechanical equipment is often said to be due to the lack of spare parts. For the maintenance of civil works Government priority and ability to mobilize the labor force hold the key. In South Asian countries, the dry season during which all the civil work maintenance must be done coincides with low employment opportunities on farms. The choice is between (1) leaving labor force unemployed, and the roads, canals, drains, embankments, dikes, grain and fertilizer warehouses in disrepair, or (2) providing employment and keeping all the rural infrastructure in good repair. The choice should

...2

obviously be the latter, but the Government must recognize the effect of the maintenance work on next year's production and be willing to give priority to it in its annual budget allocation. The foundation of the rural public work program will remain weak unless adequate maintenance is assured. Increased dialogue between IDA and borrowing countries is necessary; this could be made best by the sector survey missions. Burma's negligence in maintaining embankment in the delta area and the cumulative abandonment of one million ac of paddy land, and Pakistan's leaving its 60,000 miles of water courses at extremely low irrigation efficiency while heavy investments have been made in reservoirs are glaring examples of what labor intensive rural public works could have decisively contributed to the country's economy.

4. Re (iii) - The operational classification for Bank purposes of public works activities as presented in para 29 of the draft report is good.

5. Re (iv) - The project Divisions' professional manpower is now heavily taxed, because of the growing complexity of the projects themselves, and Bank's requirement of more exacting analytical methodology than before. But a number of the projects now being implemented or appraised are designed to be replicable, i.e. the Rural Development project of Bangladesh, the Paddy Land Development project of Burma, the Irrigation Improvement project of Sri Lanka, etc. When the work routine is established in the first project, the time required for processing the second and successive ones could be much less for both the Governments and the Bank. For rural public works, further work by the Bank as proposed in para 3(A) and (B) would make appraisal and supervision work much easier.

6. Re (v), answers are affirmative in case of South Asia projects.

7. Re (vi), we agree with Mr. Gulhati's statement.

8. Re (vii), yes.

9. Re (viii), yes.

HTChang:nb

✓ Agriculture + Rural
ca L I - UNDP

Mr. Leif E. Christoffersen

December 11, 1975

Tudor M. Kulatilaka

Inter-Agency Meeting on Rural Development convened by UNDP on December 8 and 9, 1975

1. I attended the meeting held at the UNDP headquarters to discuss two draft documents - one an "approaches" paper on rural development and the other a technical advisory note on "area development". All UN agencies which provide technical assistance were represented. A list of those who participated is attached.

2. UNDP has commenced preparation of these "technical advisory notes" early this year and the first of them was released in August. Their purpose is to assist UNDP Resident Representatives and UN agency field staff in a more direct understanding of and responsibility for, the selection, design and formulation of UNDP assisted projects. They aim to draw from past experience and to generate new thinking. Those already released include three notes in Agriculture, one in Education and two in Transport and Communication. Several others are under preparation and more are to follow. The two papers discussed at the meeting are the first in fields directly related to rural development. The "approaches" paper, in fact, is not strictly a technical note but is meant to pull together some current conceptualization, and to indicate possible approaches to rural development in member countries.

3. Although the draft paper had deftly side-stepped the issue of definitions, Sidney Dell (UNDP Assistant Administrator) who chaired the first session, steered the discussion in that direction and the meeting was soon in deep water. The discussion ambled along with delegates espousing the importance of the special areas covered by their agencies. The 'concensus', as summed up from the chair, was that there appeared to be a strong base for more integrated programs; urban development and rural development must proceed hand in hand; structural change in rural society was important and technology must be adapted to suit rural areas. It was evident that Uma Lele's work and the Bank policy paper had been widely read. Not surprisingly, nothing new emerged from the discussion. The need for further refinement was generally recognized.

4. The discussion on the draft document on rural development took up the rest of the first day and the morning of the second. Many amendments were suggested and a revised version with contributions from respective agencies relating to their substantive fields, is to be circulated by end of January.

5. The meeting served a useful purpose in bringing the Agencies together and incidentally to work out some co-ordination in Agency work in the field of rural development. It must be stated in fairness to UNDP, that the Advisory note exercise had commenced prior to the ACC study, but the latter had certainly been instrumental in whipping up some action. All agencies obviously were keen to be in on the subject. The delegates were appreciative of the pioneering work done by the Bank and indicated their keeness to learn from Bank experiences.

6. The following points which came out during the discussion I think,were useful in widening delegate awareness to issues at stake:-

(i) The heterogeneity of rural society needs to be appreciated and projects/programs should be formulated to address the problems of specific groups in need;

(ii) Raising levels of income alone should not be the objective of rural development; structural change and changes in "life style" should also occur;

(iii) Although some delegates considered that government commitment was a necessary precondition, others were convinced that UN agencies could help in bringing about changes in government policy through assitance in areas like institutional development;

(iv) Rural development demands multiple approaches, yet their complementarities should be borne in mind;

(v) Projects could be of varying degrees of comprehensiveness, given the constraints prevailing in different countries;

(vi) Expert personnel required for rural development work need not necessarily be of the highly qualified type and from sophisticated fields. Middle level technicians, drawn from even within the recepient country,would be more appropriate; and

(vii) Agencies must be frank in admiting their own limitations in this field and be ready to learn.

7. The paper on "Area Development" will undergo considerable revision. Area development was referred to several times while discussing the "Approaches" paper, as one type of integrated activity within the rural development concept. (I do not think the draft version came up with anything new or exciting.)

8. The technical advisory papers are of greater direct relevance to UNDP's country programming and technical assistance work than to Bank's own activities. We should however welcome the opportunities they could provide for concerted thinking and action in UNDP project work, which might in many cases lead to Bank participation eventually. I recommend that we keep in close contact with UNDP in this regard, and follow the "technical advisory notes", as well as any programming work arising from them.

TMKulatilaka:pm

Agriculture & Livestock

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OFFICE MEMORANDUM

TO: Files

DATE: December 11, 1975

FROM: Tudor M. Kulatilaka

SUBJECT: Seminar on Crop Insurance

A seminar on crop and livestock insurance, attended by a small but representative group of Bank staff members, was held on November 21 in Conference Room D860.

Mr. Vincent MacDonald, who as a consultant carried out a research study of crop insurance experiences in a wide range of countries, made a brief presentation based on his findings. He outlined the constraints faced in carrying out insurance programs and the resulting limitations, but stressed the benefits which could be derived specially by small farmers who generally are unable to absorb the shock of crop failure. He recommended that the Bank should take an active role in encouraging crop insurance, initially perhaps through pilot or experimental projects.

In the ensuing discussion the following points were raised:

(i) Crop insurance programs have not been self sustaining even in developed countries. State support is needed at least to meet administrative costs, although premia could sustain indemnity liabilities. Some social costs are inevitable but the benefits obtained usually justified such investments.

(ii) The constraints listed in the draft report are common to all agricultural development efforts, and could be overcome in specific situations.

(iii) A distinction should be made between insurance against: (a) disaster risks; and (b) risks arising from technological innovation. The Bank has a duty to explore the possibilities of minimizing the latter category, through its project work, and insurance may be one way of doing so. Some action has already been initiated by the Bank in this direction,

The issue relating to computation of indemnity payment based on acturial criteria, was discussed at length. Mr. MacDonald felt that many of the programs he studied had failed to be viable due to disregard of this factor. Several discussants were of the view that strict actuarial criteria could not be employed in most LDCs as; (a) farmers were small and their numbers were large making individual computations too costly; (b) grouping them together, as was suggested, is difficult due to lack of homogeneity; and (c) many farmers practised multiple cropping and not monoculture, (partly as a means of self-insurance) which complicated the calculations of premia and indemnities.

TMKulatilaka:pm

Agriculture + Rural Dev

See Distribution

December 9, 1975

Colin Bruce, Chief, Economics and Resources Division, AGP

Agricultural Incentives in Developing Countries

1. At Mr. McNamara's request, a study on agricultural incentives (prices and subsidies) and taxes is being undertaken by CPS and DPS. While the study could eventually lead to the formulation and adoption of generally applicable policy conclusions and recommendations, the initial stage of the work will consist of a detailed analysis of specific country case studies. In order to facilitate the work, and to make it as meaningful as possible from an operational standpoint, we request your assistance in providing us the following:

a) Identification of countries within your region where the above problems are particularly acute and which you would like to see included as case studies; and

b) Information on any relevant studies (structure of incentives, pricing policy, supply and demand response to price changes) that you may be aware of.

2. I should be grateful if you could respond to this request by c.o.b, January 7, 1976.

Cleared with and cc: G. Brown

Dist: D.W.M. Haynes
J.B. Hendry
R.E. Rowe
H. Vergin
R. Picciotto
H. Pollan
P. Glaessner

cc: Messrs. Yudelman
Burki
Ballesteros

MBallesteros:mt

Agricultural & Rural Dev

Mr. Robert S. McNamara

December 5, 1975

J. Burke Knapp

During our talk with Gerin-Lajoie the other day the question came up of what proportion we were financing of rural development projects and I asked Leif Christoffersen to prepare some figures relating to the twelve cases which were the subject of his recent memorandum to you.

You were right in thinking that our share of financing these projects is only around 50 percent (somewhat less for the twelve cases as a group, or somewhat more if the special case of Mexico is omitted). Local currency financing by the Bank Group represents only about 20 percent of total project costs.

Attachment.

JBKnapp:vm

Agriculture + Rural Dev.

Projects Directors; Assistant Project Directors,
for Agriculture & Rural Development and Division Chiefs of Agriculture & Rural Development Divisions

December 3, 1975

Ted J. Davis, Chief, Rural Development Monitoring Unit, CPS

Rural Development Monitoring Unit Quarterly Report

FY76 and FY77 Lending

1. Since our July report on FY75 lending for agriculture and rural development, we have conducted an intensive examination of the pipiline of such projects for FY76 and FY77, based on Project Briefs submitted to us from the Regions in early October. A full report from the Rural Development Monitoring Unit is included in Annex A. It should be noted that the detailed FY76 analysis is based on the assumptions underlying P/B Table IV-b, dated October 7, 1975. Since then the FY76 Lending Program for agriculture and rural development has been reduced from 102 to 93 projects. After a preliminary check on the principal findings in the attached report, we concluded that these would not change significantly as a result of the smaller number of projects. Therefore, since considerable staff time is needed to revise the report in details, we have decided to let it stand as it is and not delay the report further. We plan to give another full detailed analysis of the FY76 and FY77 Lending Programs in our Progress Report next February.

Country-Specific Income Levels for Defining Rural Poverty

2. You have previously received a listing of the target group income levels as prepared by the country economists. We now have a slightly updated version which I attach as Annex B. It is expected that these target income levels will be the subject of continuing work by country economists as better information is received. A paper sent to the country economists making suggestions for improved target group estimates appears as Attachment 1 to Annex B.

Establishment of an On-going PIB System

3. Mr. Baum, in a memo dated April 30, 1975, suggested that PIBs be submitted as attachments to all back-to-office reports, for all pre-appraisal missions and to the issues papers for all appraisal missions. Mr. Christoffersen requested the institution of this procedure in his memo to the Assistant Project Directos for Agriculture and Rural Development, dated September 18, 1975. Two of the Regions have already instituted this practice. The sooner the other Regions do the same, the sooner we can get the monitoring system operating in such a way that we put a minimum of burden on the Regions.

We will include the FAO/IBRD CP in the requests to complete PIBs for attachment to their preparation documents before submission to the regional division, so that information can be incorporated by the appropriate Division Chief in the Bank before submission to the Monitoring Unit. As stated above, a new quarterly report will be forthcoming next February. This will be based on the PIBs submitted as a regular part of the project cycle, and we will not ask for a complete review of all projects in the FY76 and FY77 pipeline as we did in September of this year.

Cleared and cc: Mr. Leif Christoffersen

cc: Mr. Baum
Mr. van der Tak/Mr. Carmignani
Mr. Yudelman
Mr. Turnham
Mr. Bruce
Mr. Leiserson

Agriculture & Rural Development

Mr. Anthony Cole

L. Peter Chatenay

November 26, 1975

Maisons Rurales Familiales; Visit by Mr. A. Duffaure

1. The date for Duffaure's visit is Wednesday, December 3, and not the second as I told you over the telephone. Can we still make the appointment for 2.30 p.m. as planned?

2. Attached, some documents received from Paris. They indicate that it would be useful for Duffaure to see others than the Rural Development team of CPS. Gabrielle LeBlanc pointed her finger in your direction. I am grateful for your willingness to see Duffaure.

3. My suspicion is that his interest is, in part, to find out whether there might be Bank financing for his overseas undertakings. I have told Kulatilaka in Rural Development that it might be good very early in the day to discourage any notion that the Bank has grant money for this sort of assistance. But we should, I believe, try to find out whether there is any likelihood that we could somehow mesh activities in some of the components of our rural development projects with the work carried out by the MRF or other similar non-governmental aid organizations. That is the aspect of Duffaure's visit in which I am especially interested.

Attachments

LPChatenay:mmh

/ Agriculture + Rural Dev.

cc LI - FAO

Messrs. Cole, Johanson, Pennisi, Stewart, Thint. November 21, 1975

Edward H. Chittleburgh, Training Adviser, EDPDR

Joint FAO/UNESCO/ILO Projects - "Country Master Training Plans for Agriculture and Rural Development"

1. During a recent official visit to FAO, I was introduced to this proposed project to be carried out during 1976/77 and financed under the three organizations' regular programs.

2. There is no doubt that the results arising could be of considerable interest to the Bank. FAO's Agricultural Education and Extension Service have promised to make their findings available and I shall keep you informed of developments.

cc: Messrs. Hultin, Christoffersen, Gilpin, Woods (with attachment)

EHC:rak

File: TAO/2/1

TENTATIVE DRAFT PROJECT DOCUMENT

COUNTRY MASTER TRAINING PLANS

FOR

AGRICULTURAL AND RURAL DEVELOPMENT

II. Background

Country Master Training Plans is a project which will be executed in several member countries of FAO. In the initial stage the project will be carried out in seven or eight countries as pilote activities. Expansion of the project to cover more countries will follow later after evaluation of the work. Preparation and execution of the project will be done in collaboration between FAO and concerned UN Agencies as: Unesco, ILO, UNDP, etc. The project background given below presents brief descriptions of the kinds of main training activities undertaken by developing countries and UN Agencies to provide these countries with needed trained manpower for agricultural and rural development. It also includes statements of objectives for training by FAO Governing Bodies, Regional Conferences and World Food Conference.

1. Training Activities Undertaken by Individual Countries

Developing countries, following in general the steps of the advanced world, have undertaken substantial efforts in establishing their own systems of agricultural education and training in the rural sector. The progress made in this field shows large differences between individual countries as well as between regions. While some countries have established institutions and training centres which are able to provide them with their need of trained personnel, some others are still facing difficulties in creating and staffing suitable training systems to meet their immediate needs. A common feature among all developing countries in the field of training is the shortage in the middle level trained personnel in agriculture, the unsuitability of training systems at this level and the negligeable training effort made so far in promoting knowledge and skills needed for rural development. Activities of deve-

loping countries in the field of agricultural education and training can be grouped under the following headings:

a) Agricultural Faculties - Agricultural Faculties are established in a number of developing countries as components of national universities or as independent institutions. Most agricultural faculties are under the Ministries or National Education. The main objective of these faculties is to produce graduates and specialists to meet national needs of senior personnel of various technical services. Government subsidies to agricultural faculties drew, in some cases, a flow of candidates who seek higher education without secured possibilities of employment after graduation. The ambition of many countries in creating national faculties of agriculture has been, on many occasions, fulfilled to the detriment of the quality of teaching offered by these institutions. Recruitment for Government posts is highly based on diplomas and degrees rather than qualifications for particular jobs. This left no job incentives for middle level trained personnel and resulted in a slow progress in the intermediate level of training and in a big shortage of trained personnel at this level.

On the other hand, curricula and enrolment in agricultural faculties are not always based on the country's actual needs.

b) Intermediate Agricultural Institutions - Intermediate agricultural institutions in developing countries will remain, for a long time to come, the main sources for providing agricultural extension field workers and various kinds of technicians to staff

agricultural services. The increasing cost of university education and the difficult work conditions in rural areas show that providing suitable intermediate training to young trainees from rural areas is a more realistic approach to create technical personnel to serve rural families.

Despite substantial efforts made by developing countries to strengthen their agricultural training systems at the intermediate level, a great deal is still to be desired in this respect. Almost every developing country has established or is in the process of establishing one or more intermediate agricultural institutes. However, the objectives of these institutes still need to be based on the country's actual training needs.

c) Training Centres - Holding training centres for a period ranging from one week to several months is a useful approach adopted by several developing countries. However, duration, frequency and programme content can be largely improved if the country's training needs are well identified.

d) Fellowships - Most developing countries have started building up their technical personnel in agriculture through providing or acquiring fellowships from various financial sources for their people to study abroad. Those fellows who returned back to their respective countries formed the first elements of the agricultural technical staff in these countries. Fellowship can be made more beneficial to developing countries if subject matters for training are chosen according to the countries needs and if trainees, after finishing their studies, return to their lines of work.

(Additional information obtained from Unesco and ILO on this topic will be added.)

2. Attempts to Assess Trained Manpower for the Agricultural and Rural Sector in Developing Countries

a) Countries Efforts - Several attempts have been made by developing countries and international organizations aiming at the assessment of trained manpower in the agricultural and rural sector. Some country development plans include estimations of the country's needs for trained personnel in agriculture. Although these estimations are useful in giving some indications for training activities, they are not always bases on actual facts which can form the basis for actions designed to meet the problems of the rural sector.

b) FAO Indicative World Plan - Indicative World Plan includes FAO's first attempt to estimate countries needs in trained manpower for agricultural production. Figures and ratios mentioned in this document were largely used by agricultural planners to calculate numbers of trained personnel at various levels. However, the rapid socio-economic and technical change which happened during the past decade made Indicative World Plan bases for estimation somehow irrelevant. On the other hand, there is a felt need for a deeper country focused study to identify the country's need for trained personnel with regard to quantity and quality in the light of the proposed development plans.

c) ILO Manpower Studies - ILO is conducting studies in developing countries to assess manpower available and to project the countries needs in the future. It is useful to examine to what extent the agricultural sector has been treated in these studies with necessary details to identify real training needs.

3. Training Activities Undertaken by FAO, Unesco and ILO in the Agricultural and Rural Sector in Developing Countries

Training activities undertaken by FAO, Unesco and ILO for agricultural and rural development in developing countries include technical and material assistance to faculties of agriculture, schools and training institutions at various levels; technical assistance to training centres and sessions; fellowships, etc. (for more details please see Annex I).

4. Interest and Support for Training

FAO's governing bodies and the World Food Conference have emphasized the importance of training in the process of agricultural and rural development. They have adopted a certain number of resolutions in support of larger and more comprehensive efforts in this field. The paragraphs are extracts from resolutions related to this subject:

a) Sixty-Third Session of the FAO Council - July 1974 - (Extracts from Report of the Second Session of the Committee on Agriculture)

"Agricultural extension efforts had to be greatly expanded to train much larger numbers of staff at levels which best ensured a widespread and effective contact between farmers and the extension system, with new motivation and new skills. Efforts should be made to expand and raise the level of education of farmers to make them better prepared for the acceptance and implementation of technical innovations. Special efforts should also be made to reach rural women, with adequate training programmes to cater to their needs, while new rural communications systems should be introduced which provide for a two-way flow of information."

"Agricultural extension and training, including stimulating research to widen the range of means for speeding up and broadening the communication of knowledge to the farming community, and promoting their adoption, including the feed-back of information and response from the farmers."

b) Extracts from Sixty-Fourth Session of FAO Council - August 1974 - (Report of Twenty-Fifth Session of the Programme Committee)

"... the Committee drew attention to the emphasis placed on extension by the second session of the Committee on Agriculture (COAG), which had indicated the need for more effective extension systems, particularly to ensure effective rapport with the rural population. It noted that COAG had also drawn attention to the need for a substantial increase in extension training on the parts of Member Nations, aimed at massive dissemination of the new technologies so that they would reach down to the small farmer. The Committee recognized that a heavy demand would be placed on sub-programme 2.1.2.1., General Agricultural Education, Training and Extension, if the sub-programme was to meet the challenge, in cooperation with the technical subject-matter sub-programmes..."

"It [the Committee] recognized that for FAO to provide adequate support in the many fields concerned, an organization-wide effort was required to make a systematic assessment, not only of extension work per se, but also of the whole FAO training endeavour...".

c) Extract from Sixty-Sixth Session of FAO Council - June 1975 (Report of the Third Session of the Committee on Agriculture)

103. "The Committee felt that training was the heart of the whole subject. Attention was drawn to the heavy cost of training, particularly for developing countries, which pointed to the need for greater reliance on methods which could create a multiplier effect. There should be network of training activities covering pre-service training, in-service training and non-formal training, which are all equally important and inter-dependent. The Committee was of the view that the time was ripe for a world-wide survey of the extension services in dndividual countries with a view to ascertain the strengths and weaknesses, including, inter alia, data on contact rates, constraints and results achieved. It would be also quite advisable to renew experience of cooperation where different situations arise but which focus on the efforts of extension and training service. In this connextion the Committee endorsed FAO's proposal for "master-plans" for training based on identifying the gaps in both formal and non-formal training facilities and in making recommendations on how to fill these gaps. FAO/Unesco/ILO would be involved through the Inter-Secretariat Working Group in drawing up the design for studies which would be discussed with governmentx and the studies would then be carried out through local universities/institutions with support from governments and FAO. The studies would be on a country by country basis and regional offices would also be associated.

Funds for some studies would be met from the regular programme but there would be need for extra-budgetary support if wide coverage was to be obtained. FAO would collaborate with donors on this endeavour and would like to use material already available with donors. The Committee also felt that it would be desirable if FAO could indicate trends for future technical assistance in the field of extension and training so that steps may be taken to meet these needs as and when they arrive."

d) Resolutions of World Food Conference, 1974

Resolutions IV. Food and Agricultural Research, Extension and Training

9. (v) "priority be given to, and increased resources made available for, the development of agricultural education and training at all levels, in order that the required training programmes can be provided...".

9. (viii) "... national and international resources devoted to agricultural research, extension and training in and for developing countries should be increased several fold in real terms by 1985".

1. "urges all governments to evaluate the scope and organization of their national agricultural research, training and extension programmes, and their linkages with relevant universities, international and regional institutions, and agro-industry research efforts, with a view to taking all necessary measures (including additional financial provision) to strengthen national programmes to cover priority areas of food and agricultural production more adequately, including inter alia environmental and socio-economic considerations".

Resolution V. Policies and Programmes to Improve Nutrition

1. (Recommends) "... that all governments and the international community as a whole, in pursuance of their determination to eliminate within a decade hunger and malnutrition, formulate and integrate concerned food and nutritional plans and policies aiming at improvement of consumption patterns in their socio-economic and agricultural planning.....".

III. Justification of the Project

1. One of the key factors in agricultural and rural development is the provision of education and training in order to provide for trained manpower to staff the essential development services and to offer adequate education and training facilities to farm families and other members of the rural community. This has been emphasized repeatedly in meetings of the FAO Council, the Regional Conferences, the Committee of Agriculture and other bodies. Most recently, the World Food Conference recommended "that priority be given to, and increased resources made available for the development of agricultural education and training at all levels" 1/ and also that "national, regional and international resources devoted to agricultural research, extension and training in and for developing countries should be increased severalfold in real terms by 1985". 2/

2. At least 80 developing countries, faced with pressing problems of developing the rural sector in an integrated manner, need to adapt their agricultural education extension and training systems to this wider goal. Often a small number of unqualified workers thinly scattered in remote areas are undertaking the important task of advising farmers; structures of training systems, formal, and non-formal, to provide the personnel needed for the different tasks involved in agricultural and rural development do not form an adequate basis for carrying out the training required; individual institutions

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1/ World Food Conference Resolution IV item (v).
2/ World Food Conference Resolution IV item (viii).

within the system function in isolation from other units and from the actual needs of the country; training programmes are not adapted to national needs in terms of numbers trained, level of training and subjects of specialization; communication methods are often not suitable for reaching the masses of rural populations; current approaches do not in most cases provide for integrated training programmes for all members of the farm family, nor for the integration of this activity in the overall national development process; in-service training for the improvement of professional capability of personnel working in agricultural and rural development is receiving very little attention in developing countries.

3. In order to assist developing countries in strengthening education and training both formal and non-formal, within the overall framework of integrated rural development it is necessary to help them in designing and executing comprehensive master training plans for agricultural and rural development. Such plans should be based on studies at the country level to determine training needs in the context of anticipated levels of agricultural and rural development, identify deficiencies in education and training systems and curricula and recommend realistic measures for essential improvements which will be required to meet the future needs for trained agricultural and rural development personnel. In this work particular attention will be given to the need for intensified training efforts focussed on local level institutions and on training in the local environment where people live and work.

4. The Agricultural Education and Extension Service (ESHE) at FAO Headquarters has developed a programme element for the biennium 1976/77 under the title "Country Master Plans: Training for Agriculture and Rural Development". This programme element was discussed and approved at a meeting of the Inter-Divisional Working Group on Education and Training (IDWG) on 6 March 1975. The preparation of such master plans will be done in collaboration with other units in FAO and with our sister agencies through the Inter-Secretariat Working Group on Agricultural Education, Science and Training. The work will be integrated with regional programmes in this field and there will be a common or united approach to all activities. Moreover, it is planned that in the design, execution and any follow-up action, all technical divisions concerned with training will actively participate. The master design will also be coordinated with Unesco and ILO so that a common design acceptable to all agencies is approved.

IV. Objectives of the Project

The Long-Term Objective

The long-term objective of this project is to assist countries with problems of training for agriculture and rural development at all levels and in both formal and non-formal areas, including the various agricultural extension, rural youth and related services to the farming community, and to adapt their rural training systems to the development of the rural sectors in an integrated manner.

The Immediate Objective

The immediate objective of the project is to assist developing countries in designing Country Master Training Plans to meet present and future national training needs for agricultural and rural development.

The development of a Country Master Training Plan will involve the following actions:

A. A country study which includes:

1. Present situation and anticipated future needs of trained personnel for agricultural and rural development

a) Assess the present situation and anticipated future needs of the trained personnel engaged in the provision of services to the agricultural and rural sector within each country, whether these are provided by government, quasi-government bodies, the commercial private sector, or by farmers' own organizations. It would include a survey of the existing stock or number of trained personnel by training level and subject-matter, staff structure, coverage of each service, and so far as possible, data on operational costs. The present and future staffing pattern would be related to current agricultural and rural population distribution and future population projections, and to present and future institutional structures, farming systems and rural development policies within the country (or the part of it) being studied. This assessment will also cover factors affecting the quality of training and the utilization of trained personnel in agriculture; e.g., facilities, transport and equipment needed to do their job effectively, career prospects, comparative salary structures, in-service training, development and technical support resources, staff mobility, etc. The study will draw on ILO experience in this field and make use of available information and materials in ILO related to its objectives. Close collaboration with ILO personnel and activities in each country is highly desirable.

2. Detailed Review and Evaluation of Current Formal Agricultural Education and Training Systems

a) Assess the general impact of the formal agricultural education and training institutions and programmes of agricultural and rural development.

b) Appraise the methods employed in planning the entire agricultural education and training system and examine the process of decision-making at national and local levels.

c) Examine the structure of the agricultural education system, the relationship between different levels and institutional structures within the system and its relationship to other public or private agencies promoting agricultural and rural development. At provincial and local levels, check on the coordination and cooperation with all services operating in the rural areas.

d) Examine the existing individual institutions regarding organization, capacity, relevance of training programmes offered, teaching methods, staffing, physical facilities, drop-out and wastage rates.

e) Examine capital and recurrent costs of agricultural education, by level and by institution, costs per student and per graduate. Unesco experience in the field of agricultural education will be of great importance to this study. Close collaboration will be maintained with Unesco at all levels.

3. Review and Evaluation of Current Agricultural Extension and other related Non-Formal Education and Training System

a) Assess the general impact of the agricultural extension programme and other non-formal education and training programmes for farmers, rural home-makers and out-of-school rural youth.

b) Appraise the current policy and present methods of planning for these forms of non-formal education and training - including the understanding and support of national planners and policy makers as to the role of these programmes in agricultural and rural development.

c) Examine the current and planned strength and scope of these agencies and programmes, evaluating their major strengths and weaknesses. Determining, for example, whether the extension programme includes work with all members of the farm family, reaches all areas and levels/types of farm families, is adequate to handle extension services in all subject-matter areas, makes effective use of volunteer leadership, has an adequate pre-service and in-service staff training programme, provides its field staff with suitable supervision and support, etc. Similar questions would be investigated in other programme areas.

d) Examine the training needs and programmes of various services supporting rural population such as cooperatives, credit, marketing, etc.

e) Study existing relationship between these programmes and national policies and programmes relating to needed changes in the agrarian structure.

f) Analyze and evaluate the extent to which these non-formal education and training programmes are integrated with other aspects of agricultural/rural development, i.e. formal education systems, cooperatives, credit, marketing, improvement of physical infrastructure, people's organizations, employment promotion programmes, etc.

g) Examine the capital and recurrent costs, and other financial aspects of these programmes in relation to national budget and planning.

4. Review of Future Plans for Agricultural and Rural Development

a) Examine Government's future objectives for agricultural and rural development and proposed future plans of action.

b) Examine Government's proposed targets for increase in agricultural production in various fields.

c) Examine current and proposed projects and activities to achieve these objectives.

d) Examine Government's provisions allocated for the development plans.

e) Estimate the requirements for trained manpower at all levels, to staff the main agricultural services, e.g. agricultural extension (including home economics and rural youth work), education, research/experimentation and veterinary forestry, fisheries services and of supporting services, e.g. cooperative management, marketing, credit, community development, as well as the probable needs of the commercial and private sector; estimate the present and future socio-economic capacity to absorb the trained people, and the probable costs involved.

f) Provide an analysis of the implications of such trained manpower requirements for the present and projected education and training systems of the country, both formal and non-formal, including plans for institutional development and estimates of the probable capital and recurrent costs involved.

B. A national meeting will be held at the conclusion of the study to discuss the results and recommendations of the study and to identify the main lines of the Country Master Training Plan. Representatives of the three Agencies: FAO, Unesco and ILO will attend this meeting.

C. Based on activities under A and B a Master Training Plan will be developed in collaboration with national authorities. The Plan will include the following main aspects:

a) a projection of the country's needs in trained manpower for agricultural and rural development for the text ten years;

b) recommendations regarding the organization of the training systems, formal and non-formal;

c) recommendations on the improvement of training programmes and curricula;

d) strategy and project ideas for the execution of the Country Master Training Plan.

V. Structure and Operations of the Project

1. FAO Headquarters

Preparation of Country Master Training Plans for agricultural and rural development will be made in collaboration between the Agricultural Education, Extension and Rural Youth Service (ESHE) and various FAO Departments and Divisions. Training officers in various technical Divisions in FAO will participate in the planning of the project, structuring the project's design, preparing needed materials and in the follow-up of the work in the field. ESHE officers who are responsible for the projects will constitute ad hoc technical groups with training officers of other FAO Divisions to prepare the work together and to review the progress accomplished in the project.

2. Collaboration with Unesco and ILO - Headquarters

Collaboration between FAO, Unesco and ILO in the Country Master Training Plans will be done, at Headquarters level, through ISWG. Agricultural Education and Training Units in Unesco and ILO will be requested to contribute to the planning of the design and to the implementation of the project. Selection of countries in which the project will be executed will be made in collaboration with the two

sister Agencies. Experiences of the three Agencies - FAO, Unesco and ILO - in the field of edudational planning ar l training for agricultural and rural development will be made available for the preparation of the necessary designs for Dountry Master Plans.

3. Country Level

a) Sponsoring National Agency - It is the privilege of the participating Government to designate the national sponsoring agency of the project. On the other hand, since training activities in rural areas are mainly in the agricultural field, it is likely that the Ministry of agriculture would be the Government Agency designated for this purpose. This Ministry will have to conduct the work in close collaboration with all ministries and agencies concerned with agricultural and rural development, e.g. Ministries of Education, Rural Development, etc. It is very important that the Ministry of Planning should be involved in the project from its inception.

b) Collaboration with Unesco and ILO - At the country level FAO project's personnel should have close collaboration with representatives of Unesco and ILO in the country. Experts of the two sister Agencies working in training projects in the country will be invited to provide all possible assistance to the project, each in his field of specialization. The project will have close collaboration with training projects and activities executed jointly or separately by the three Agencies in the country.

c) National Institution - To be of maximum value in each country, the work involved should be put in a continuing basis and should desirably be carried out by a national institutions, wich such assistance and guidance from FAO, Unesco and ILO as may be required. In this way, such institutions could become a significant part of the country's agricultural development planning machinery, as well as an additional source of data both on the national and international level. Among other advantages, this would lead to more satisfactory means of assessment and evaluation of investments in agricultural education and training, and in the various kinds of agricultural services.

B. Management of the Project

1. Overall Responsible for Project

ESHE has designated an officer as coordinator for the Country Master Training Plans. However, the project will be executed in a large number of interested developing countries and, therefore, all education officers in ESHE and other FAO Technical Services will be involved in its planning and implementation. The responsibility of the Project Coordinator is to promote actions in this area, make the necessary contacts with the concerned FAO units and international organizations, develop needed materials and documentation and ensure an effective execution of activities. In other words, he represents the work of the ESHE Service in this field. Coordination between the international Agencies in the management of the project will be done through ISWG.

2. Direction Committee

To ensure effective collaboration between all international and national agencies involved in the project a Direction Committee will be organized in the country to discuss and decide on major actions required for a successful execution of the project. The Chairman of the Committee will be the representative of the national sponsoring agency. Members of the Direction Committee will be nominated from representatives of ministries and national agencies involved in the project. Representatives of FAO, Unesco and ILO or senior officers of these organizations will be nominated members of the Committee. The donor agency, whether it is UNDP or a bilateral agency, will be represented by a member in the Committee. The Committee will decide on the number and dates of meetings to be held during the implementation of the project.

3. Technical Committees

An ad hoc technical committee for each field (agricultural education, agricultural extension, in-service training, management, etc.) should be established to assist in collecting the needed information and discussing the recommendations which will be considered in the preparation of the Master Training Plan. National specialists as well as experts of FAO, Unesco and ILO, working in the country will be invited to serve in technical committees.

4. Consultant for Collection of Data and Information

There will be a need for consultants to carry out the study in each country. A consultant may be an expatriate or a national specialist recruited for this particular job. He may also be a staff member of the institution which will be contracted to analyze the data and prepare the final report.

5. Data Analysis and Final Report

As mentioned in part V c) of this document a national institution will be contracted to collaborate in the collection of information and to analyze collected data and information and prepare the final report of the study phase of the project. It may happen that the institution also furnishes the consultant who carries out the collection of information.

C. Estimated Cost by Country

The following estimated costs do not include salaries of the Agencies, Headquarters, and Regional Officers for the time spent on this project.

	US$
- 12 man-months consultants	37,200
- Contracts with national institutions	5,000
- Travel (for consultants and FAO Officers to visit countries and FAO Headquarters and the Regional Office for consultation)	5,000
- Contractual services	1,000
Total:	48,200

BAIP
Central File
Agriculture + Rural

Mr. Ravi Gulhati, ECDDR

November 20, 1975.

James B. Hendry, Assistant Director, Eastern Africa Projects

Issues Paper - Bank Financing of Rural Public Works

In response to your memo of November 12, please find below my comments on the specific points which were raised therein. Unfortunately I won't be able to participate in the working level review because I will be away from Washington until mid-December.

(1) The condition that Public Works include only the physical infrastructure seems to me a sensible definition.

(2) From reading the original Harvard DAS study, as well as the draft Issues Paper, I agree with the conclusion that Public Works cannot play a major role in alleviating poverty and utilizing the labor force. The data which have been gathered covering the wide range of Public Works efforts in a large sample of countries do not seem to give much support to any but this rather pessemistic conclusion.

(3) The operational classification of Public Works activities seems to be a useful one.

(4) I agree that the best opportunities for Bank support of Public Works activities are likely to arise in the context of projects. In fact, I see little change in this from what is already being done in many countries on a force account basis, and given the experience with public works programs where a project focus is lacking this seems the most likely direction for future bank involvement. Looked at from this standpoint I don't see that staff needs are likely to be greater than those provided under our normal project co-efficients.

(5) I believe the experience in the Eastern Africa Region has been that bank policies have not hindered the use of Bank/IDA funds for essential local financing, nor have they led to unrealistic insistence on ICB where local conditions were not conducive to ICB.

(6) From the tenor the comments above you can see that I tend to believe there is not much scope for the bank to support widely dispersed public works programs (with all of their attendant defects), but should direct any such involvement toward project-related infrastructure.

(7) If the future bank lending for public works is considered as force account infrastructure, there may be some experience on which to base estimates of new lending.

(8) I agree that establishment of quantitative targets for Bank support of Public Works would not be appropriate.

cc: Messrs. WALTON, WALDEN

JBHendry:of

✓ Agriculture & Rural Dev
cc DFC Fin. Comp

Mr. Edwin M. Martin

November 19, 1975

G.F. Darnell

Bank Organization of Agricultural Credit and DFC Divisions

With regard to your memorandum of November 14, 1975, the following points are relevant.

(i) The evolution of agricultural credit projects was within the old Agriculture Department. The origins of the DFC structure was earlier and subject to different evolutionary forces in terms of both development thinking and Bank organization.

(ii) Not all Regions have a DFC Division nor DFC staff, thus a Central Projects Division exists to undertake project work for DFC's. Many DFC's provide credit for agriculture.

(iii) Where DFC Divisions exist in the Regions they are located under the same Assistant Director Projects as the Agricultural Credit Division. In some cases, the two are in the same Division - e.g., in South Asia Region.

(iv) At the time of the Bank's re-organization in 1973, all staff units (including the agricultural credit group) were divided into five (now six) regionalized groups. It was considered that this was advantageous at that time; the reasons are outlined in the re-organization documents.

(v) The Agriculture and Rural Development Department, CPS, has responsibility for coordination and information exchange regarding farm credit within the Bank. This Department also prepared the Bank's Agricultural Credit Sector Policy Paper. There is a Senior Adviser on Agricultural Credit and several others in this Department who take an interest in all aspects of credit provision for agriculture. We review all agricultural credit projects.

(vi) Mr. G. Alter in the Senior Vice Presidents office takes an overall interest in the institutional arrangements and lending conditions for both types of credit projects.

(vii) The commonality of country experience may not be as strong as you suggest. The USAID Spring Review and the recent FAO/CARIPLO study both reveal distinct regional differences in traditional credit forms, institutional arrangements and credit needs or uses.

(viii) We have always, but increasingly in recent years, seen credit as one component in an overall agricultural package rather than something to be regarded in isolation. As the trend toward providing shorter term credit grows, the scope for treating farm credit in isolation has further declined. Consequently, the point of splitting off agricultural credit from agricultural projects in general is not strongly apparent at this time.

(ix) The Rural Development strategy being pursued by the Bank is specifically concerned with integrating various sub-sectors and sectors. Institutional separation would seem to be counter to this.

cc: M. Yudelman
C. Bruce

GFDonaldson:pt

Agriculture + Rural Dev.

SecM75-794

FROM: The Secretary

November 18, 1975

NON-FARM RURAL EMPLOYMENT

At the meeting of the Executive Directors held on June 17, 1975, responding to comments made by Executive Directors, the Chairman said that a paper would be prepared discussing the problems of non-agricultural employment in rural areas. The attached note, prepared in the Agriculture and Rural Development Department, is in the nature of an interim report, to be followed over the next year by a further and more detailed study.

Distribution:

Executive Directors and Alternates
President
Senior Vice President, Operations
Executive Vice President and Vice President, IFC
President's Council
Directors and Department Heads, Bank and IFC

THE BANK AND NON-FARM RURAL EMPLOYMENT

1. Extent, Growth and Location of Non-Farm Rural Employment

1.1 A large and increasing number of rural people in developing countries are finding employment outside of farming - in rural areas, villages and country towns. We might define this area, beyond the major cities, as the "non-farm rural sector". The major sources of employment in this sector are agro-industries, farm supply and service industries, rural commerce, small consumer good manufacturers, and public sector industries responsible for building and maintaining rural infrastructure. Impressive evidence of growth in the non-farm rural sector is seen in the expansion of villages and towns, which in several countries appear to be as rapid as that of the major cities; (see Table 1).

Table 1: Population Trends by Community Size in Six Latin American Countries 1/

Town/City Size Range 1970 (000's)	No. of Towns/Cities 1970	Population (000's) 1950	1960	1970	% Total for 1970	Growth Rate 1960-70
20 - 50	383	4,429	7,635	11,878	12.1%	4.5%
50 -100	122	3,658	5,623	8,523	8.7%	4.4%
100 -250	81	4,745	7,556	12,014	12.2%	4.8%
250	46	10,217	16,193	25,886	26.4%	4.8%
Big cities	7	16,885	25,881	39,869	40.6%	4.4%

Many of the small towns were villages twenty years ago; their populations have increased much faster than the natural growth rate, implying substantial net migration into them. The limited survey work that has so far been undertaken in these communities has uniformly pointed to a surprisingly diverse and growing

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1/ Argentina, Brazil, Chile, Mexico, Peru and Venezuela. There is similar evidence available for Korea, India, Taiwan and Turkey.

number of non-farm activities; the number and diversity are most marked in Latin America, as one might expect, but they are also significant in other regions, including Africa.

1.2 That the proportion of rural people not directly employed in agriculture should be growing is not wholly unexpected. The normal path of economic development involves the release of people from the pursuit of subsistence and their movement out of agriculture into other, often related, economic activities. This reflects the growing specialization of labor that has characterized the growth of all civilizations throughout history. In less favorable situations, it also reflects the continued growth of population which, in relation to a fixed land base, makes it necessary for an increasing proportion of people to seek their livelihood in productive pursuits other than farming. The forced movement of people out of farming need not be an unfavorable development effect so long as (i) agricultural productivity increases sufficiently to provide a supply of food at affordable prices, and (ii) other sectors of the economy experience sufficient growth to provide gainful employment.

1.3 Apart from releasing the food constraint so as to permit the general growth of industry and commerce, rural development programs directly promote the growth of industry and commerce in both urban and rural areas -- but particularly in what we have termed the non-farm rural sector. First, an increase of farm incomes leads to increased demands for locally provided consumer goods and services; second, rising farm output requires increased inputs of farm supplies and services, again, often locally supplied; third, increased farm outputs are associated with increased agro-industrial processing on both a large scale (for extenral markets) and a small scale (mainly for local markets); and fourth,

the building and maintenance of new infrastructure such as roads, irrigation works, schools, markets, storage facilities, electricity lines and water supplies, etc., creates new jobs. There is, of course, a two-way relationship, insofar as the growth of the non-farm rural sector benefits local agriculture by providing enlarged markets for farm output.

2. The Bank's Role

2.1 The Bank's rural development strategy recognizes the existence of a growing and potentially productive non-farm rural sector, although the Bank has not as yet isolated this sector *per se* for direct project investment (there is an exception in the case of agro-industrial projects, but the focus of these has, until now, been on increasing quality produce for export or city markets with little regard for employment effects). The primary emphasis in pursuing agriculture and rural development has been in expanding farm productivity. This has been based on the understanding that not only are a large proportion of rural people engaged in farming (in most cases the majority), but as just indicated, that the next largest group (those in the non-farm rural sector) are those indirectly involved in agricultural production, either through providing farm services or processing farm output. A considerable number of these rural development projects have in fact included direct investments in the storage, processing, or marketing of farm products or in the production of local inputs such as seeds.

2.2 It is especially notable that infrastructure investments associated with rural development programs usually support non-farm activities peripheral to agriculture more directly than they do farming itself. Thus improved roads directly benefit those involved in transport and trade of farm products, (who may or may not be farmers); electric power benefits those employed in or operating

small industries producing farm inputs or processing farm output; and the establishing of credit and input supply services and social services all create non-farm jobs. Further, investments associated with social components of rural development programs usually benefit farm and non-farm people in villages relatively equally. Thus, village water supplies, health clinics or village schools potentially benefit both groups. There are, in fact, few rural development project components that do not benefit non-farm groups, though generally the farming population is likely to benefit most.

2.3 The Bank has provided funds for a number of projects that directly benefitted the non-farm rural target group through increasing employment. As shown in Table 2, these include over the time period 1970-75, 15 projects with rural roads components, 18 with rural education, 9 with rural health and 13 agro-industries projects, as well as one or two water supply and rural electrification schemes. In addition, there have been some rural employment effects from predominantly urban infrastructure projects (not listed), such as the water supply projects for Mombasa in Kenya, Acra-Tema in Ghana, Guayaguil and Guayas Provinces in Ecuador, and coastal Tunisia; and the electrification projects in Kenya, Brazil and Ecuador. This listing does not include the 63 "new style" multi-sectoral rural development projects of the past two years which are expected to create added employment for non-farm as well as farm people in rural areas.

2.4 There remains the question as to what can be done in addition to the provision of infrastructure or direct investment in rural services as part of rural development projects aimed at raising farm production. There are three possibilities now being examined within the context of Bank research and policy work programs. First is the scope for extending credit and extension facilities

directly to the rural non-farm sector, and how this may be done in the context of Bank lending operations. Second is the balance of infrastructure investments between the rural areas, villages and towns situated in areas with growing non-farm rural population; rural development projects may be overly focussed, for example, on the small villages and rural areas - perhaps the larger villages and towns in the project areas require extra assistance from the projects. Third is the question of pricing, tax and subsidy policies and how they impinge on the relative growth of industry and commerce in urban and rural areas.

2.5 It is also recognized that regional planning, based on resource surveys and spatial analysis, and the development of new growth centers are of primary importance in extending economic development to non-farm rural groups. Consequently, these issues are receiving specific attention in the Bank's economic and sector work program. Additional research studies in this area are also proposed, and the Bank is providing technical assistance to member countries for regional planning, including remote sensing technology, as currently in Indonesia and the Philippines.

2.6 A paper will be prepared over the next year on the subject of employment creation and income generation for non-farm rural people, based on studies currently under way. This paper will include a survey of evidence on the scope for expanding employment in this area and the types of activities involved, including: agricultural linkages, both forward (processing, transport) and backward (manufacture of tools, input supply); mining and forestry development; small scale rural industries; decentralized large scale industries; and, rural public works and infrastructure programs.

Table 2: Projects Directly Affecting Non-Farm Rural People 1970-1975

Country	Project Name	Loan or Credit No.	Total Project Cost	Rural Component	Bank/IDA Financing
Rural Roads					
Senegal	Highway Project	198 SE	2.5	2.5	2.1
Tanzania	Highway III	265 TA	9.5	6.5	6.5
	Highway IV	507 TA	12.5	5.5	10.2
Ethiopia	Highway V	332 ET	22.0	22.0	17.0
	Roads VI	552 ET	54.7	32.0	32.0
Malawi	Highway II	523 MAI	12.5	3.0	10.0
Swaziland	Roads II	1108 SW	9.9	6.0	7.0
Zaire	Highway III	536 ZR	40.3	19.0	26.0
Mali	Highway II	383 MLI	-	6.0	8.3
Sierra Leone	Highway I	710 SL	52.1	1.5	2.3
Upper Volta	Rural Roads	579 UV	8.5	7.5	7.5
Mauritania	Highway III	519 MAU	13.7	3.0	3.0
Yemen PDR	Highway II	560 YDR	31.8	8.0	15.5
Paraguay	Highway IV	1059 PA	20.0	7.5	14.5
Brazil	Highway V	1075 BR	276.0	30.0	110.0
Rural Education					
Chile	Vocational Training II	666 CH	3.0	0.8	1.5
Costa Rica	Education I	915 CR	9.4	2.21	6.2
Honduras	Education	954 HO			
	"	452 HO	8.66	6.88	6.0
El Salvador	Education II	1007 ES	24.0	1/	17.0
Dominican Rep.	Education II	1142	13.54	5.0 2/	8.0
Guyana	Education II	544 GY			
	"	1106 GY	18.9	1/	12.0
Tanzania	Education III	232 TA	4.7	4.7	3.3
Upper Volta	Education I	430 UV	3.6	3.6	2.8
Mauritania	Education	459 MAU	4.6	1/	3.8
Ethiopia	Education IV	553	34.68	11.5	23.0
Sudan	Education II	547 SU	10.0	1/	10.0
Somalia	Education II	511 SO	9.3	5.5 2/	8.0
Swaziland	Education	518 SW	7.1	1.5	5.0
Dahomey	Education	N/A	5.5	1/	4.0
Lesotho	Education II	497 LE	8.14	1/	4.0
Rwanda	Education	567 RW	9.0	1/	8.0
Rural Electrification					
India	Rural Elect.	572 IN	114.1	114.1	57.0

Country	Project Name	Loan or Credit No.	Total Project Cost	Rural Component	Bank/IDA Financing
Rural Water Supply					
India	Uttar Pradesh Water Supply & Sewerage	1009 IN	72.0	29.3	40.0
Rural Health					
Kenya	Population	468 KE	38.8	8.8	12.0
Tunisia	"	238 TUN	7.7	3.6	4.8
Egypt	"	437 EGT	10.5	4/	5.0
Jamaica	"	690 JM	3.0	0.4 3/	2.0
India	"	312 IN	31.8	4/	21.2
Indonesia	"	300 IND	33.0	4/	13.2
Malaysia	"	880 MA	14.5	0.5 3/	5.0
Iran	"	928 IRN	33.4	20.3	16.5
Philippines	"	1035 PH	50.0	12.8 3/	25.0
Agro Industries					
Korea	Agric. Processing	994 KO	20.0		13.0
	Seeds	942 KO	22.8		7.0
Philippines	Rice Processing	720	20.9		14.3
Bangladesh	Cereal Seeds	410	10.6		7.5
India	Grain Storage	267	15.0		5.0
	Bihar Wholesale Mkts.	294	23.3		14.0
	Agric. Mysore Mkts.	378	12.0		8.8
	Apple Processing	456	21.7		13.0
Iraq	Grain Storage I	925	92.0		40.0
Yugoslavia	Macedonia Industries	894	62.0		31.0
Brazil	Grain Storage	857	75.0		30.0
	Agric. Export Indust.I	924	135.0		54.0
Ethiopia	Coffee Processing I	290	10.3		6.3

Source: World Bank Appraisal Reports.

Note: 1/ Figures for Rural education are not specified but are obviously quite high since the project is heavily weighted toward rural education.

2/ Approximate

3/ Construction cost only. Excludes equipment and other related costs.

4/ Not specified.

Agriculture & Rural Dev.

Mr. Leif E. Christoffersen, Assist. Dir., AGP

November 17, 1975

D.J. Parsons, Acting Assist. Dir., ASP

Rural Development Working Paper No. II - Forestry in Rural Development

I have asked Mr. Harma to comment on the draft, and attach a copy of his memo to me of November 14 for your information.

For myself I find difficulty in envisaging a forestry component in a rural development project other than for the provision of farm wood lots or, if land can be found that is suitable, small scale, well distributed plantations designed to produce the local requirements of fire wood and building poles.

I consider this important subject should be considered in the forestry policy paper that is under preparation, rather than in a separate paper such as you suggest.

DJParsons/cta

cc: Messrs. Yudelman
Picciotto (o/r)

INTERNATIONAL DEVELOPMENT ASSOCIATION | INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT | INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: Mr. Dennis J. Parsons, Acting Asst. Director, ASP DATE: November 14, 1975

FROM: Risto Harma, ASPGA

SUBJECT: Comments on "Forestry in Rural Development, Rural Development Working Paper 2 (Draft Dated October 15, 1975)"

1. The paper ignores the historic pattern of forest industry development. Trade in timber and processed forest industry products developed initially in today's leading forest industry countries on the basis of indigenous timber - not on the basis of planted timber. In this situation the indigenous timber resources provided capital on which the developments referred to were drawing, besides drawing other capital.

2. It is also worth noting that the biggest commercial/industrial plantations exist in industrially advanced countries such as those of Central Europe, United Kingdom, Australia, South Africa and Brazil; also the latter is well on its way to industrialization. In these cases, the plantations have been created in support of thriving development in non-agricultural sectors, including wood processing industry. Private forest owners have actively participated in replenishment planting activity in European countries.

3. In contrast, the working paper envisages that plantation forestry commences forest-based development. Moreover, envisaged developments require public subsidies. This puts a drain on financial resources of the country. Whether developing countries can afford this on a significant scale remains largely unproven.

4. Forest product production for local market can be monetized only if there is already a thriving development going on in non-agricultural sectors to which forestry makes an input.

5. Finally, fuel production is an immense problem in countries such as India and Pakistan. In view of this and the lack of purchasing power with rural population, a fuelwood planting program can have a significant coverage only if it is based almost exclusively on farmer participation.

6. In conclusion, it is not clear whether the reviewed Working Paper fully appreciated the above aspects.

RHarma:sk

Agriculture + Rural Dev
cc IFC

November 13, 1975

Mr. J.A. Dickson
Chairman of the Standing Committee
on Commonwealth Forestry
Forestry Commission
231 Corstorphine Road
Edinburgh, EH 12 7AT
Scotland

Dear Mr. Dickson:

Thank you for your letter addressed to Mr. McNamara of 10 October and the Tenth Commonwealth Forestry Conference report.

The degree to which we are able to finance local costs in Bank projects, including forestry and forest industrial projects, depends on many factors which are kept under constant review. These include the country's needs, its per capita income level and the importance of promoting specific sectors such as rural and urban development. Although we have become more flexible over this matter in recent years as a general rule we finance local expenditures only in exceptional circumstances in which a country is unable to raise the required local finance. Such lending relates particularly to high priority projects which have a low foreign exchange component. In these circumstances, we make foreign exchange available to cover part of local costs.

As far as forestry projects are concerned our position was accurately expressed in Mr. Spears' paper presented at your Conference entitled "Methods of Financing Forestry" in the section dealing with problem areas.

In all but one of our six forestry plantation projects and in a forestry technical assistance project we have financed a proportion of local costs; we have not done so in any of our road construction, logging or forest industrial projects. You may be interested in the percentage of local costs covered by our loans for the following:

.../

			Percentage
1968	Zambia	Industrial Plantations	Nil
1970	Kenya I	Industrial Plantations	48
1975	Kenya II	Industrial Plantations	17
1973	Mauritius	Plantations	35
1974	Philippines	Industrial Plantations	75
1975	Madagascar	Industrial Plantations	71
1975	Tanzania	Industrial Plantations	65
1975	India	Forestry Technical Assistance	37

I think these figures speak for themselves and hope the information will be useful.

Yours sincerely,

George F. Darnell
Assistant Director
Agriculture & Rural Development Dept.,
Central Projects Staff

agriculture + Rural

INTERNATIONAL DEVELOPMENT ASSOCIATION | INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT | INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: See Distribution List

DATE: November 12, 1975

FROM: Ravi Gulhati, ECDDR

SUBJECT: Issues in Bank Financing of Rural Public Works

For comment pl.

1. Attached is a preliminary draft of the Issues Paper on Public Works prepared by Mark Leiserson and Ralph Hofmeister in collaboration with S. Burki. This follows the Harvard study on the same topic. A digest of the latter is also being distributed as background material. Your comments are invited and they will guide the revision that will take place shortly. The present version is rather long; we hope to prune it in the next round.

2. More specifically, we would like your advice on the following points;

(i) Public Works are defined as activities concerned with the creation of physical infrastructure only (para. 20). This means that construction of health clinics and school buildings and extension depots are included but the operation of health workers, teachers and extension workers are excluded. Is this a sensible definition?

(ii) The draft suggests that Public Works cannot play a major role in the alleviation of poverty and utilization of the labor force (paras. 13, 21, 22). Do you agree with this conclusion?

(iii) An operational classification for Bank purposes of Public Works activities is presented in para. 29. Is this a useful schema?

(iv) Largely for organizational and administrative reasons, the more attractive opportunities for Bank support of Public Works activities are likely to arise in the context of sectoral projects--roads, irrigation, water supply, education, population, etc. or the new-style area-based rural development projects. To exploit these opportunities fully will require substantial inputs of Bank staff during the preparation, appraisal, monitoring and evaluation of these projects. Are these staff needs fully allowed for in existing work programs and budgets?

(v) No major departures are required in Bank policy and procedure to exploit these opportunities. Is this so? Are rules regarding (a) uses of Bank/IDA loans for financing local expenditures and (b) international or local competitive bidding sufficiently flexible?

(vi) Bank support for national or regional programs consisting of widely dispersed Public Works is likely to be severely constrained by a combination of political, organizational and administrative problems in member countries. No easy solution to these problems have been identified by the Harvard Study or by Bank Staff. Despite these difficulties, we should stand ready to support such programs wherever there exists a framework within which the member government and the Bank can learn through actual field experience.

(vii) There is insufficient experience on which to base estimates of future Bank lending for Public Works.

(viii) The establishment at this time of quantitative targets for Bank support of Public Works would not be appropriate.

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WORKING DRAFT
November 11, 1975

ISSUES IN BANK FINANCING OF RURAL PUBLIC WORKS

Employment and Rural Development Division
Development Economics Department

ISSUES IN BANK FINANCING OF RURAL PUBLIC WORKS

Summary and Conclusions (to be written)

I. Introduction

II. Rural Public Works Activities: Concept and Definition

- A. Program Types and Characteristics
- B. Some Analytic Distinctions
- C. An Operational Classification of Rural Works Activities

III. Organization and Administration of Rural Public Works Programs: Some General Considerations

- A. Political Factors
- B. Centralization and Decentralization in Administration
- C. Work Organization and Institution-Building
- D. Budgetary Allocations and Local Resource Mobilization

IV. Issues in Project Design, Appraisal and Implementation

- A. General Design Characteristics
  1. Project selection
  2. Labor intensive design
  3. Wage policy
- B. Project Appraisal Criteria
  1. Economic Rate of Return and Distributional Considerations
  2. Maintenance
- C. Bank Project Management
  1. Preparation
  2. Project Analysis Procedures
  3. Supervision
  4. Evaluation

V. Prospects for Bank Financing of Rural Public Works (to be revised and completed)

- A. Past Bank Experience and Current Activity
- B. Prospects

DRAFT
RHofmeister/MLeiserson
November 10, 1975

ISSUES IN BANK FINANCING OF RURAL PUBLIC WORKS

I. Introduction

1. Over recent years Bank policies and programs have placed increasing emphasis on the urgency of ensuring greater participation by low income groups in the benefits of economic development. It has been recognized that this requires explicit attention to the employment opportunities for the poor whose economic welfare depends primarily upon their ability to engage in remunerative work. Moreover, the unemployment and underemployment of human resources in developing countries not only represents a waste which can be ill afforded but is likely to involve vicious cycles of poverty, malnutrition, and low productivity which present major obstacles to vigorous development efforts. Public works programs are among the more obvious instruments for mobilizing underutilized labor for productive investments with accompanying benefits in the form of additional employment and incomes for some of the poorest workers.

2. In 1972, Mr. McNamara said that the Bank would assist in financing such projects.[1/] The Bank has since participated in a public works programs in Mauritius and supported a significant amount of rural public works activity as components of projects in India, Mali, East Jordan, and Mexico. In the Bank's Sector Policy Paper on Rural Development, public works projects were identified as potentially useful means to meet special needs in

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1/ Robert S. McNamara, Address to the Board of Governors, Washington, D.C.: IBRD, September 25, 1971, p. 16.

rural development programs such as employing the landless.[1/] However, the multiple objectives and the organizational and administrative complexities of public works programs combine to pose difficult issues of design and implementation.

3. An extensive review and analysis of experience throughout the developing world with so-called public works programs (sponsored by the Bank and carried out by the Harvard Institute for International Development) reveals the wide range, diversity and mixed results of such programs. (A digest of the final report of this study is attached as an addendum to this paper.) Drawing on this review of experience, the Rural Development Policy paper of the Bank identified certain salient weaknesses which have impeded public works programs from realizing their full potential for channeling income to low income families while adding to rural infrastructure at low opportunity costs.

"(1) The portion of total program expenditures going to unskilled workers is frequently less than it might be because unnecessarily equipment-intensive construction methods are used.

(2) Projects may be poorly selected and designed, resulting in high-cost investment and low efficiency in terms of income supplements to the needy.

(3) Inadequate management and supervision may produce a "make-work" character and consequent high-cost structures and low morale.

(4) Some programs have tended to extend into the peak demand periods for agricultural labor.

1/ IBRD, Rural Development: Sector Policy Paper, Washington, D.C., February, 1975.

(5) When 'self-help' elements are included, the poor usually are required to contribute their labor with very small or no wage payments.

(6) Payment in kind is administratively cumbersome and frequently very inefficient for the workers as they resell inappropriate commodities at a large discount.

(7) The appropriate blend of local initiative and decision making with central control is difficult to achieve.

(8) Influential groups may alter programs so as to increase their own benefits at the cost of the poor."[1/]

The general conclusions drawn in the Rural Development policy paper were that public works have to be part of a larger employment and development strategy and that the Bank would devote increasing effort within the lending program to develop projects which incorporate rural works in an integrated rural development effort.

4. The purpose of this paper is to provide a concise analysis of the central policy and operational issues involved in the selection, design, appraisal and evaluation of rural public works activities for Bank financing. It does not presume to suggest definitive policy conclusions but it does seek to formulate clearly certain tentative policy positions.

5. This paper is limited to a discussion of rural public works and does not investigate equally difficult and often analogous issues within primarily urban public works projects. In larger urban centers, the physical and economic environment as well as the structure and operation

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1/ IBRD, Rural Development: Sector Policy Paper, Washington, D.C., February 1975, p. 51.

of labor markets requires public works efforts substantially different from rural areas. The openly unemployed are more of a problem in cities, but many of them are not members of the poorest family groups and are uninterested in unskilled manual jobs. Increased public works employment in cities might stimulate increased rural-urban migration of unskilled workers, possibly in excess of the jobs created. Policies on urban public works must be therefore evolved in the context of an appropriate urban development strategy--a task beyond the scope of the present paper. However, the demarcation between rural and urban cannot be drawn with great precision and independently of the circumstances. In particular, rural public works activities may in fact be physically located in rural towns and villages. The crucial consideration is the integration of such activities into the rural economy and in general, this would exclude projects and programs focusing on the larger, more industrialized urban centers.[1/]

6. The basic issue to which this paper is addressed is how rural public works activities can be most effectively incorporated into rural development programs and Bank lending. A particular question is whether the Bank should develop a separate portfolio of loans for rural public works projects. It is taken for granted that a variety of local rural works activities will receive increasing Bank support within regular irrigation, transportation, and other agricultural and rural infrastructure

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1/ It is of course possible or even likely that a national public works program may involve both rural and urban components. Unlike the practice to date, a public works approach evolved in the rural context should not be uncritically extended to urban areas. The urban component should be designed explicitly for the urban environment.

projects, or as specific components of integrated rural development projects in particular areas. To determine what developmental objectives can be served by extending Bank support of rural works and what operational problems must be faced in so doing requires a careful specification of the distinctive characteristics of rural works programs and a working definition of rural works projects for Bank operational purposes. The next section of the paper is devoted to this task. Subsequent sections examine particular issues in the selection, design, appraisal, supervision, and evaluation of Bank financed rural works activities. A final section considers the prospects for Bank financing of rural works projects.

II. Rural Public Works Activities

A. Program Types and Characteristics

7. Rural public works programs as generally conceived encompass a wide range of activities with a correspondingly diverse set of objectives. The ostensible purposes for which such programs are undertaken usually involve a complex mixture of economic, social and political ends which all too frequently are not clearly stated and may be inconsistent.

8. The above noted Harvard study on public works, based on an analysis of 36 programs in 20 countries, found that all 36 programs were initiated in a context of substantial unemployment and/or politically unacceptable low incomes for some groups of the population. Program objectives ranged from attempts to balance the objectives of employment and income creation for target groups on the one hand, and the creation of useful economic assets on the other. However, all countries did not perceive these problems in the same way, with the result that there

was considerable variation in program emphasis and design. It was for this reason that the Harvard team found it useful to employ a typology based on the types of benefits delivered and the target groups that received them. The following four-way classification[1/] was used:

(i) Relief Programs. These programs responded to emergency conditions by supplementing or replacing incomes reduced or destroyed by natural calamity. They were planned to cover at least one full crop cycle, although provisions were made to permit some slowdown of work activity during planting and/or harvesting seasons. Examples of this type of program are India's Scarcity Relief and Afghanistan's Provisional Development Program.

(ii) Long-term Employment Programs. The target groups in these programs faced a long-term structural employment problem because of the limited capacity of the agricultural sector to absorb new entrants to the labor force. In these cases there was a need for providing long-term support with an accent on training for new vocations, possible resettlement schemes, land reclamation where possible, and relief for high levels of urban unemployment. Examples are Mauritius' Travail Pour Tous and Jamaica's Special Employment Program.

(iii) Income-augmenting Programs. These programs supplemented

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1/ This typology is obviously only one of the many ways in which public works activities might be classified and, for a number of reasons, it does not appear to be altogether appropriate for an analysis of Bank operations in these areas. A more operationally useful classification is developed below in Sections II(B) and (C).

normal activity on the part of the target groups and, as a result, were planned to take advantage of seasonal employment patterns. Their main purpose was to provide incomes in addition to those that could be obtained from normal economic activities. They did not necessarily aim at the agricultural population; many programs had large sections of the non-agricultural rural population as the target group. The emphasis on seasonality resulted in the inclusion of short-term projects in the program portfolio, or inclusion of those projects that could be conveniently interrupted during agriculture seasons. Examples are the Public Works Programs in East Pakistan/Bangladesh, West Pakistan's Rural Works Program, and Morocco's Promotion Nationale.

(iv) Low-cost Infrastructure Programs. Ostensibly the target groups for these programs were generally the same as for long-term employment or income-augmenting programs, but the accent was on the assets created rather than the income provided. Most of these programs paid very low wages to the labor employed; some, relying on self-help, paid no wages whatsoever. An example is Indonesia's DESA Program.

9. In formulating this typology, the Harvard team emphasized the fact that over time there was considerable movement of programs between categories. Mostly political, but at times economic, considerations kept relief programs going even after the crisis had passed. For instance,

India's Drought Prone Areas Program (launched in Maharashtra after the state suffered from extreme dry weather for a couple of years) has been transformed into an income-augmenting type of program. On the other end of the spectrum, Mauritius' Travail Pour Tous Program has now assumed the form of a low-cost infrastructure program.

10. The experience documented in the Harvard study reveals certain limits on the effectiveness of public works programs. Employment generating public works scheme cannot solve unemployment and poverty; it is an instrument which can reach only a part of the poor. The actual gains to the poor are easily overstated; many households are unable to gain from such schemes; and the feasible scale will generally be inadequate to the need.

11. The fraction of total program expenditures accruing as real income gains to unskilled workers is more limited than has been generally realized. Despite best efforts in both project selection and in labor-intensive techniques, it appears unlikely that the unskilled wage fraction of total program expenditure ever exceeds two-thirds (including the unskilled wage component of locally produced materials) so long as there is a serious concern for creating productive assets and the wage rate approximates the non-peak agricultural wage. Higher reported fractions in several programs are suspect because of the omissions of substantial program costs from the program budget, and because of lax and biased reporting procedures. Further, the real income gains will be significantly less than the wages paid. The costs of the increased food consumption necessitated by heavy physical labor will constitute a significant fraction of the modest wages received. There may be small but non-negligible costs

from casual earnings foregone while on public works employment. Aside from any disutility effects of the work, and after discounting of the wage payments to reflect actual real income gains, the transfer of real resources to poor groups may approximate one-half of total program expenditures, at best. For some classes of construction, e.g., buildings for schools or health clinics, the ratio may be much less due to relatively higher outlays for materials and skilled labor.

12. Many household, including some of the poorest, will not benefit from public works schemes. Among the poorest are those households with no person physically capable of performing heavy work. Even if this is due to illness or injury, a vicious circle of low income, poor nutrition and health, low productivity, and consequent low income may be established. Also many households are poor because of the number of dependents relying on the modest earnings of one or several members. If employment is continuous and if earnings are already comparable to the public works wages, the latter are of no benefit.

13. The scale of public works schemes has been small relative to existing unemployment and underemployment. From the survey of programs reported in the Harvard study it appears that only rarely have the number of workers hired been more than a few percent of the effectively unemployed.

14. In most contexts the potential, if not actual, employment and income effects of the completed assets will exceed those of the constructions phase. For example, in land-augmenting works such as irrigation, permanent employment for one worker may be created with three or four

man-years of construction labor. However, these permanent benefits will not follow automatically; without the requisite inputs and complementary policies they may be small or non-existent. For infrastructure projects such as access roads, the expected benefits will come only with parallel developments larger in scope and more difficult to achieve than the initial public works.

15. Perhaps the most intractable of constraints on the effectiveness of public works efforts arise from conflicts inherent in the program and its environment. Frequently, the poorest regions are those which have limited agricultural potential even with major investments: arid lands with no water resources for irrigation is the most pervasive example. On grounds of the immediate employment and income needs such regions might have a high priority for public works activities. However, given the physical resources, there would be very limited permanent creation of jobs.

Income and public works efforts in such an environment would sacrifice productive investments elsewhere without solving the long-run local employment and income problem.

16. The institutional setting, especially land tenure, may also restrict the achievement of distributional objectives in public works schemes. The chief beneficiaries of the resulting permanent income flows may be non-target groups, even the highest of the local income groups. The causation is direct in the case of land-augmenting investments which yield substantial employment and income increases in a land-scarce region. In a market economy, the major portion of the enhanced land productivity will accrue to the landowner, that is, the major share of the permanent

benefits will be distributed about as equally as is land ownership. Further, the labor share (or the implicit labor return to a tenant) will depend on the character and magnitude of the induced labor demand. Certain patterns of technical change associated with the increased land productivity could minimize the employment effects, e.g., labor saving mechanization.

17. Finally, some public works program may have net effects which are perverse for distributional objectives. If poor laborers are forced to contribute work on projects which enhance the returns to large landholders, there is income redistribution from the poor to the rich. Less extreme are programs paying wages but whose permanent benefits, concentrated among the well-to-do, more than off-set the temporary gains to the poor during the construction phase.

18. Despite the welter of difficulties, confusion of objectives, and mixed results which can be found in the experience of developing countries with public works programs, that same experience also provides ample evidence of the potential contributions which such programs can make in pursuing development strategies in which the alleviation of poverty receives greater emphasis. But if there is one general lesson to be drawn from the variety of experience, it is that to make effective use of public works programs as instruments for improving the income and employment levels of the rural poor requires a careful sorting out of their role in meeting the objectives of development policy and clearer analytic guidelines both for the design of such programs and for determining the circumstances in which they should be undertaken.

B. Some Analytic Distinctions

19. It is apparent that the diverse type activities to which the label public works programs has been applied do not constitute a sufficiently clearly defined set to be operationally useful for determining policy with respect to the design, appraisal and evaluation of rural works programs and projects. For these purposes, additional analytic distinctions are needed to clarify the character and extent of the possibilities for Bank financing and to provide operational guidance for incorporating rural public works in Bank lending.

20. The scope of rural works activities in the succeeding sections of this paper is confined to those activities concerned with the creation of physical infrastructure under governmental or communal auspices. Under such a definition rural works activities may appear as components of programs or projects with specific sectoral objectives whether in agriculture, power, transportation, education, health, or rural development. Or they may be the focus for separately identifiable rural works programs and projects. In all cases, however, they are distinguished as activities designed to alleviate rural poverty through rural development.

21. Although the rationale for using public works in developing countries to raise incomes through the employment of underutilized labor resources may appear analogous to the use of public works program to alleviate cyclical unemployment in developed countries, it is important and instructive to emphasize the differences. The low utilization of labor and poverty in the rural areas of developing countries cannot usually be ascribed to a generalized deficiency of aggregate demand but arises from

other real constraints on the level of output and productivity. Simply put, employment programs in developing countries cannot be based on the assumption of high elasticities of supply (not only of labor but also of other goods and services) which underlies counter cyclical public works programs in developed economies. The direct effect of additional employment incomes on the welfare of the workers is dependent upon the increased availability of consumer goods to meet the resulting additional demand. If there is no provision for an increase in total consumption goods, the distributional effect will depend on which groups suffer reductions in consumption levels in order to the meet the additional demand from workers on public works projects; whether these effects are favorable in an overall sense will, therefore depend on such factors as the structure of taxation and the relative vulnerability of different groups to increases in the prices of wage goods. Insofar as increase in consumption goods involves a diversion of resources from other investment activities, the distributional and employment benefits of employment generating works programs have to be weighed against the adverse effects on development objectives and the possible loss of employment opportunities in other areas which lower investment levels might entail.

22. This perhaps oversimplified analysis is not intended to denigrate the potential contribution which public works program can make in evolving development strategies which accord primary importance to improving the welfare of the poorest groups. But it does illustrate the

limited validity of expressing the fundamental goal of increasing the incomes of the poor in the form of a separable employment objective. The employment problems of developing countries are closely bound to the whole complex of constraints on incomes and productivity; employment creating works programs in developing countries (in contrast to those in developed countries confronted with deficiencies of aggregate demand) must be designed and evaluated with explicit attention to the longer run patterns of development and the overall economic policy context.

23. Emphasis on the long-run structural character of employment problems in developing countries does not, of course, mean that acute emergency or shorter run problems do not arise in which employment-generating work programs may well be appropriate instruments to assist in relieving the economic distress of the particular groups affected. However, such situations are distinguishable as having their causes in disruptions on the supply side (droughts, floods, typhoons) or in the localized impact of shifts in the structure of demand, rather than a generalized deficiency of aggregate demand. Under these circumstances, the alleviation of distress is a problem of transferring resources to sustain the consumption of the affected groups. Providing employment through public works schemes under these short-run circumstances is one means of administering this redistribution; judgments of their effectiveness may have relatively little to do with the actual output produced but turn on the extent to which using wage employment as a channel for the transfer of consumer goods compared to alternative transfer mechanisms minimizes administrative or political problems of selection of recipients,

possibilities for corruption, etc.[1/]

24. Emergency employment and work relief programs as vehicles for redistribution must certainly be recognized by the Bank as both desirable and important in particular circumstances. At the same time the relative unimportance of production or development criteria in the design and appraisal of such schemes are likely to make them unsuitable for long-term project lending. Bank financial support to obviate the adverse effects of natural disasters are more effectively managed through program lending for reconstruction and rehabilitation rather than direct support of more open-ended and longer term work relief programs.[2/]

25. At the other extreme from employment programs in which relief or redistributive objectives are paramount one may distinguish employment-generating public works activities which are or could be carried out under the label of rural works programs in which the production aspects are of principal concern. These relate to labor intensive or small-scale components of large infrastructure programs and projects--large dams, irrigation works, major road systems, flood control structures, etc.--which happen to be located in rural areas with underutilized labor resources. In

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1/ Cf. Amartya Sen, Employment, Technology and Development, Oxford, 1975, pp. 83-84.

2/ Such a policy position would not exclude the possibility of direct assistance components in Bank financed projects where deleterious indirect impacts on specific low income groups can be identified. An example might be expansion of large scale textile manufacturing or modernization of the fishing industry which wipes out the economic base of rural weaving or local fishing activities. But such components should be designed as adjustment assistance including elements of retraining, relocation, etc., and not simply employment relief.

situations where the scale of the project is so large that the direct local generation of temporary employment incomes is of minor importance relative to the direct and indirect effects on real incomes extending well beyond the boundaries of the immediate surrounding area, the use of labor intensive techniques is a question which is properly addressed within the standard framework of technical and economic evaluation of projects. This is simply to recognize that in many circumstances the direct generation of additional employment incomes for low wage workers in a particular area may not be even a good partial indicator of the distributive consequences for all those whose real living standards are importantly affected by the project. A major dam and irrigation system to increase production on large mechanized farms ought not to be favorably considered on distributive grounds if, at some cost in efficiency, it is carried out with more labor intensive techniques. Conversely, a project of this sort which is judged to be worthwhile when its overall production and distributive effects are evaluated at appropriate shadow price should not be constrained to use inefficient employment generating techniques in pursuit of a separate distributive goal of increasing the incomes of locally employed low wage labor. Within the logic of formal techniques for the economic analysis of projects the benefits of increased employment generation are properly subsumed in the evaluation of the net benefit streams resulting from the project. And explicit consideration may be given to the distribution of both direct and indirect benefits among various groups by attaching

different distributional weights to benefits according to the income status of the different groups to which they accrue.[1/]

26. If essentially relief or income transfer activities are generally inappropriate for Bank project lending, and if distributive aspects of primarily production oriented projects can be handled within the framework of project analytical techniques currently being developed for application for Bank projects generally, the question arises whether an operationally relevant set of rural works activities can be identified as a distinct focus for Bank project financing. In other words, is there any reason for particular efforts to increase the amount of Bank lending for project activities providing additional employment and incomes for the rural poor beyond what would result from incorporating distributional considerations explicitly and systematically into project appraisals which determine whether projects meet acceptable rate of return criteria? The already established Bank policy of giving greater emphasis to lending for rural development is based on an affirmative answer to this question. Such criteria are not to be considered sufficient conditions for investment decisions. In particular, as current Bank policy recognizes that a deliberate poverty oriented strategy requires an increased effort to seek out and develop rural development programs and projects with acceptable rates of return. And, as is stated in the Rural Development policy paper, rural public works can be effective components of rural development programs.[2/]

1/ See H. van der Tak and L. Squire, "The Economic Analysis of Projects." Bank Staff Working Paper No. 194, IBRD, February 1975.

2/ IBRD, Rural Development: Sector Policy Paper, Washington, D.C., February 1975, p.

27. The grounds for this position are rooted in the limitations--practical and theoretical--of quantitative evaluation techniques in assessing both distributional and developmental consequences of particular investments. As is discussed in more detail later (Section IV B), the use of distributional weights in project evaluation provides a systematic way for analyzing investment alternatives taking explicit account of the impact on the income levels of different economic groups. But estimates of the direct and indirect changes in incomes to which any set of such weights are to applied are difficult to make with precision. The logic of the procedure requires, for example, more than just a comparison between equilibrium income positions before and after an investment takes place; the distribution among individuals of the costs and benefits of moving from one position to another should also, in principle, enter into the calculations. The complexities involved in the quantification of these distributional changes over time can hardly be exaggerated. And their importance is likely to be the greater the more rapid and the more profound the changes affecting the technological, economic and social structures of the rural economy. These complexities are not simply a matter of insufficient statistical data. They reflect limitations which stem from the need to assess individual project activities against the broader context of rural development strategies--of initiating and supporting a cumultative development process in which opportunities for economic advancement are more widely dispersed among the rural poor and the costs of adjustment are not disproportionately concentrated on those groups least able to bear them.

C. An Operational Classification of Rural Works Activities

29. From the distinction drawn in the preceding section, the following fourfold classification of rural works activities can be made with particular reference to the different problems and potentials for Bank financing.

(1) Emergency employment and work relief programs,

(2) Small scale, labor intensive infrastructure components of large, centralized sector investment projects,

(3) Local infrastructure components of integrated area or rural development projects, and

(4) National or regional programs for local or decentralized public works.

30. Activities falling in the first of these categories are, as noted previously, unlikely to offer many opportunities for Bank project financing except in special circumstances. Rural works components of sectoral investment or rural development projects--the second and third categories--are likely to be of growing significance for the Bank. They represent a potentially important means for spreading the benefits of Bank financed projects to lower income groups while maintaining essential standards of economic efficiency and growth in productivity. And for reasons explained in Section III below, the operational issues posed for the Bank in the analysis and appraisal of rural works activities can be expected to be more manageable within the framework of larger projects where they can be addressed as questions of efficient project design and appropriate activity-mix to meet specific, well-defined production and poverty-alleviating objectives.

31. It is the fourth category of more broadly based rural public works programs which presents the greater challenges for Bank policy and procedures. The difficult issues which the Bank faces in formulating public works projects of this sort are closely connected with certain of their distinguishing characteristics. No matter how well-founded the presumption that substantial opportunities exist in rural areas where small-scale public works activities can simultaneously yield production and poverty-alleviating benefits, the central problem is the means by which a large number of specific opportunities can be identified and efficient methods can be found for directing capital and labor resources to their exploitation. For rural works programs to serve as a mechanism for mobilizing local capacities to identify and carry out a wide range of geographically dispersed, small scale activities requires an administrative structure with a substantial degree of local autonomy and decentralization. Since, in the nature of the case, it will not be possible to specify and control in fine detail the content of individual project activities, the crucial issues, program design and appraisal will center on the institutional context and administrative and financial procedures for carrying out the program. By and large these must be expected to involve separate organizational and financing arrangements which cut across the functional responsibilities of central government ministries and are more closely tied to support of local government and rural development institutions.

32. From this point of view, the potential role of rural works programs is in some ways analogous to other intermediary development institutions designed to channel resources to a large number of decentralized

decision makers such as Development Finance Corporations, agricultural credit agencies or institutions providing finance and technical assistance to small enterprises. However, the analogy cannot be pushed too far since the differences are as significant as any similarities. In particular, the public or communal character of rural infrastructure activities means that there is no simple counterpart to the profitability criteria which can be applied in dealing with individual business enterprises. Moreover, the redistributive objectives of rural works programs may mean that financing will take the form of grants out of general government revenues rather than lending to local instrumentalities. For these and other reasons, consideration of Bank financing of rural works programs cannot avoid complex issues of the operational criteria to be applied of program design, appraisal and evaluation. In the sections that follow some of the more important of these issues are examined with particular emphasis on the problems posed for Bank operational policies and procedures.

III. Organization and Administration of Rural Public Works Programs: Some General Considerations

33. Perhaps the most fundamental issue to be considered in connection with rural public works programs is that of their relation to general development policy and administration. It is all too easy to assert the desirability (or "necessity") for integrating these programs into a coherent overall system of development, planning and policy. It is infinitely more difficult to give meaning to such exhortations through a reasonably precise specification of what forms integration should take and how in fact it can be accomplished.

A. Political Factors

34. Public works are inescapably political. The same can, of course, be said for the project investment decisions whether they be steel mills, power plants, highway construction, or whatever. In the case of rural works activities, however, the Bank faces distinctive problems because of the difficulty in establishing that workable separation of the more technical and objective considerations from political influences at all levels of project formulation and implementation upon which Bank involvement can be agreed upon without it being drawn too far into the arena of internal political controversy at both the national and local levels. In virtually all public works efforts political motivations are strong, even central, in initiation, design, and implementation.

35. Possible political motives range across the spectrum from an unambiguous commitment to improving permanently the lot of the poorer groups in the population to a desire for simple palliatives to quiet unrest and there is no sure way for determining which motives are the

prevailing ones. Various identifiable groups, both inside and outside the government may have quite different intents regarding public works. Further, for success the political motivation must be sustained over a long period. A government, regime, or influential political group will not back public works without regard to its perceptions of its own political and economic interests and these are subjecto to gradual or drastic shifts over time.

36. Very rarely if ever will there be common political motives and unanimity among all influential groups regarding public works. Further, it would be unusual if any one group or grouping of interests could, by reason of its relative strength, or would, considering the drain on its stock of political capital, impose its view without concession or compromise with other groups. Some degree of inconsistency among objectives and means is likely.[1/]

37. Within the programs involving local decentralized rural works, conflicts about the type and location of assets to be built can be expected to be pervasive. Excepting perhaps the generally small fraction of the total represented by social infrastructure, benefits from the completed structures will go primarily to those owning fixed assets, especially land. Especially if holdings are highly skewed, land owners are likely to exert substantial political influence at the local level and possibly at higher levels. Evidence from past works programs confirms the expectation that influential land owners will seek the location and types of rural works which will enhance the productivity and profit of their own holdings.

1/ See the Digest Report, Ch..... An expanded treatment of program "mutation" as the result of political interest groups is given in Thomas (1975).

Even if adamant conflict can be avoided, influential but narrowly based economic and political interests may effectively limit the permissible local autonomy in project selection and design.

38. If a regime is seeking a broader political base than that represented by local elites, public works may be perceived as an effective instrument for enlisting and solidifying the support of lower income groups. If they have the same perception, local elites may oppose public works on straight political grounds. If the regime has insufficient strength to by-pass or overcome this opposition, the impasse and probable local subversion of public works objectives will probably make the effort ineffective, or even counterproductive. While geographic concentration may be justified by more effective deployment of limited administrative resources, in some countries political considerations may result in confinement of public works to areas of lesser political and economic inequality, at least initially.

38a. From even this brief general discussion, it is clear that Bank support of rural works activities will require a core assessment of national and local political factors and their significance for mounting and carrying out effective projects and programs. It is obviously impossible to prescribe any general system of analytic techniques and criteria by which such assessments can be arrived at. This fact alone should be recognized as a probable constraint on the extent to which the Bank should participate in direct financing of rural works activities. The difficulty of resolving on some reasonably objective basis, the political uncertainties surrounding rural works programs may require that the Bank eschew direct involvement in certain circumstances, where aside from these uncertainties, the productive and developmental contributions of rural works appear to be substantial.

The same uncertainties give added emphasis to the importance of insisting that any rural works projects have high economic potential with rates of return equal to or above those acceptable for other projects (cf. Section IV B below). Nevertheless the crucial assessments will remain those regarding the capacity of a government to establish and/or develop the organizational, administrative, institutional and fiscal mechanisms which are sufficiently robust to achieve fundamental developmental and equitable objectives despite the inevitable pressures of parochial political interests.

B. Centralization and Decentralization in Administration

39. A core problem in rural public works programs is that of administration and the demands imposed on a country's administrative resources. And a distinctive problem of organizing public works activities as an instrument for mobilizing underutilized resources for the exploitation of local productivity enhancing opportunities is the need and desirability for relying on local initiative and administration both for identification and implementation. To achieve the desired combination of economically productive results (both direct and indirect) with a wider spread of short- and long-term benefits among the poorest groups whose livelihood depends mainly on their own (usually unskilled) labor raises questions of the appropriate balance between centralization and decentralization in program design. It is clear, therefore, that organizational arrangements must be a major consideration in rural public works programs. And it is not surprising that organizational together with political factors are almost invariably observed to be determinative of actual past experience with public works programs of the sort surveyed in the Harvard Public Works Study.

40. When undertaken as components of larger infrastructure or rural development projects (categories (2) and (3) in the classification of the preceding section), the organizational and administrative problems connected with rural public works activities appear to be substantially more manageable. Properly designed, the larger project should provide a framework within which the role of the rural works components may be specified concretely in terms of overall project objectives and the reasonably clear lines of administrative authority and responsibility can be established. This is not likely to be an easy task, however (some of the particular issues which have to be faced are considered in Part IV below), and certainly will require explicit attention in the process of project identification and preparation.

41. The incorporation of rural works components into larger projects is best viewed as a problem of project design--of determining the optimal levels and mix of activities to be included in order to achieve project objectives. The challenges posed for the Bank are those of improving operational techniques of project design and analysis to take proper advantage of the productive contributions which rural works activities can make and to give systematic weight to poverty alleviating objectives in assessing project benefits. The technical and practical difficulties involved can hardly be overestimated and have already been the object of considerable work by CPS and DPS. They undoubtedly will continue to require increasing attention at both the staff and operating levels. But insofar as well-defined infrastructure or rural development projects are concerned the basic principles to be followed in the development of improved techniques of project design and analysis are fairly clearly established.

42. The situation is significantly different, however, in the case of broadly based programs for local, decentralized rural works activities (the fourth category in the classification of the preceding section). The intermediary character of such programs--the lack of a well-defined project context within which clear and measurable relationships can be established ex ante between project inputs and project objectives--implies that analysis and appraisal necessarily must focus on the organizational and administrative system for program implementation. Productive as well as distributive outcomes can be judged only indirectly from an analysis of the criteria, incentives and control procedures embedded in institutional and managerial arrangements.

43. A great variety of organizational structures and intermediaries is possible and are closely intertwined with political and financial issues. The small-scale and geographical dispersion of rural public works necessitates decentralized administration if local knowledge and initiative are to be incorporated via local participation in decision-making and implementation. Further financial decentralization would be highly desirable if substantial fractions of benefits otherwise accruing to high income groups could be captured at the local level for the benefit of the rural poor./ However, there are severe constraints on decentralization. Local government institutions, because of administrative weaknesses and/or concentrated local political influence, may be incapable of managing effectively and responsibly works projects. If a strong local economic elite effectively controls the local administration, local decision-making may be expected to produce projects which inordinately benefit the

local elite. Even broad local participation may not select an optimum mix of projects; from past experience there seems to be a relative neglect of economically productive projects and a bias in favor of social infrastructure.[1/] In most circumstances, local institutions lack manpower for the technical design and oversight of projects.

44. Provision of technical back-up, training, and review procedures at higher levels are necessary to overcome inadequacies at the local level. While a control and supervisory role is essential, it could easily dominate the planning and execution process to the extent that effective decentralization becomes substantially less than the nominal. Relaxation of project standards somewhat lower than the technical and administrative ideal may be justified when account is taken of the costs and inefficiencies of imposing tight direct administrative controls. And the benefits of local decision-making--in accommodation to the local situation, in motivation and participation of local people, and in the development of local institutions--may fully offset some theoretical inefficiencies in project design and execution. A balance, which cannot be prescribed generally, must be struck between local autonomy and more centralized administrative control.

45. However, the local capacity for project management must be realistically assessed; an administrative overload is inimical to both institutional development and good works projects. Coordination at all levels, local, regional, and central, extending across departmental responsibilities, often suffers from inter-departmental rivalries. Where inadequate local capacity precludes reliance on highly decentralized decision-making, explicit centralized control procedures are likely to be preferable

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1/ See Digest Report,

to nominal decentralization and divided responsibilities. Since the productive potential of rural works cannot be achieved without complementary inputs and programs, coordination may be the most difficult of the various dimensions of public works management and has been too much neglected in past programs. Obviously, the means for coordination are dependent on the extent of decentralization, and the desirable degree and style of decentralization, depends

inter alia on the required coordination. But at the minimum, there need to be some planning and administrative procedures whereby new rural works are made reasonably consistent with existing and planned physical infrastructure. Development of local roads needs to take into account plans for major networks while small scale irrigation works have to be consistent with larger scale plans affecting water availabilities and drainage systems.

C. Work Organization and Institution-Building

46. Past experience with rural works programs provides ample evidence (if, indeed, any be needed) that no uniformly successful methods of work organization have been discovered. For example, the use of small contractors appear to have been quite successful in Indonesia but unsatisfactory in the former East Pakistan. Alternative implementing agencies have included local government bodies, local cooperatives, and through the hierarchy of a central public works authority. The circumstances and institutional capacities of the country will determine the relative advantages of the various means. For broad, national programs the latter seems to be the least promising generally because the inefficiencies of bureaucratic decentralization are compounded by a lack of administrative experience and limited staff

resources. Only in a small and geographically concentrated program is it plausible that these disadvantages can be overcome. Reliance on contractors would not be wise if there were few contractors experienced with labor intensive techniques. Local government implementation is especially attractive where local popular participation in decision-making is possible and where local fees and taxes permit cost recovery. Cooperatives furnish a means of local involvement in lieu of effective government bodies; they are attractive for very small works at the village level or below. However, efficient implementation through cooperatives would require substantial organizational and technical inputs and might not be feasible except in regions with a very strong cooperative movement or in the context of intensive rural development.

47. Potentially, public works activities could assist in the development of local government institutions, and at least one country seems to be fairly successful in this regard. In the rural areas of many developing countries local government representatives are seen as mainly occupied in tax collection and in maintaining law and order. Perceiving that they receive few or no government services, the rural people may be understandably unenthusiastic towards government agencies. Further, the common hierarchial style of government does not encourage local initiative and participation. In such a context, rural public works would represent a positive government action. Local people could participate in project proposals, selection, and design. Imaginative cost sharing for projects highly valued in the local community would facilitate revenue collection. Partial or whole cost

recovery from completed projects could finance additional projects. However, all this will not happen automatically. And it must be emphasized that public works can play only a supportive role in this regard and cannot substitute for strong government commitment to the development of viable local administrative system.

48. In most agricultural and rural development projects, the tendency in the Bank has been to incorporate institution building in project design. The logic explicit in this approach is that the economic activity being financed is considered important enough to justify investment in institutions. Even in those situations where such an approach cannot be faulted, the Bank experience has not been very encouraging. This is particularly so for those projects that have some resemblance with public works in their demand on the recipient country's administrative capacity. For instance, in its several agricultural credit operations the Bank made little advance in institution building.[1/]

49. The conclusion to be drawn is that Bank financing of rural public works will require careful appraisals of existing and potential administrative capabilities. This will require evaluation of governmental structure in regard to the size, population density and available communication of geographic administrative units, the division of functional responsibilities, the extent and character of local participation and the adequacy of staffing in numbers and quality. Such appraisals should not be carried out in a static context, however; hardly any developing country can be expected to have in being the organizational structure and staff necessary to embark on smoothly functioning and effective rural programs of any significant

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1/ Operations Evaluation Department, Report on Bank's Agricultural Credit Operations.

size. The emphasis should rather be on evidence of sustained and realistic efforts to develop local administrative units and local institutions. Initially, organizational and staffing weaknesses may be acceptable, but continuation of support should depend on demonstrated progress toward greater administrative effectiveness and capacity. While the institution-building potential should be taken account of in project appraisal, it would be highly unrealistic for the Bank to attempt to introduce or to rely upon political and administrative innovations at the core of local government institutions.

D. Budgetary Allocations and Local Resource Mobilization

50. The centralization-decentralization issue arises in its most acute form in establishing operational criteria for budgetary allocation and exercising control over the expenditure of funds. Clear and objective operational rules are needed which are simple enough to be understood and effectively applied at all levels of administrative systems suffering from scarcity of technical staff and other ogranizational weakness. Without them public works programs almost inevitably fall prey to all sorts of abuses destructive of their original objectives as particular groups or individuals seek to exploit opportunities for political or pecuniary advantage which administrative and financial laxness provides. But whether the motivation is political or simply venal or both, the evidence is clear from past experience that the result is an increasing diversion of benefits to particular vested interest groups or a gradual demoralization and disintegration of the entire program.[1/]

1/ Digest Report, Chapter VI.

51. The need for simple objective procedures consistent with the often extremely limited administrative and technical capacity means that criteria for budgetary allocation cannot avoid a degree of arbitrariness; complex and sophisticated procedures for assuring a fully "rational" allocation will almost certainly exceed the planning and technical capabilities of the local instrumentalities implementing the program. In the case of local public works components of large centrally administered infrastructure or rural development projects, the problem may be significantly eased insofar as the allocation for and administration of those components are explicitly incorporated into the overall project design and organization. But broader, more extensive public works programs require reliance on a workable set of simple criteria which can be effectively linked to equally simple control procedures.

52. These criteria or standards may be tied to population, they may be directly linked with local contributions, they may in effect reward the winners of competition in technical and/or economic performance, or they may combine several of these. Public works funds are commonly disbursed among political subdivisions on a per capita basis, sometimes with some weighting reflecting income levels or need. Excepting emergency situations in which crudely defined absolute needs are used in the allocation, income weighting is politically difficult to establish and administer. In one country each district received an equal allocation plus the uniform per capita distribution with the result that the more sparsely populated and poorer districts received a higher per capita allotment.[1/]

1/ In fact, more than the poorer districts could spend. See Digest Report, Chapter

53. Even if a per capita formula is applied down to the lower political or administrative units, additional criteria must be applied for selecting specific projects; being physically discrete and with some indivisibilities, the projects cannot reach everyone. In fact, the allocation system can be addressed in terms of the administrative level at which performance or competitive criteria become operative. A possible performance criterion is cost-sharing in which the higher unit, up to some ceiling, matches according to pre-set proportions the funds allocated at the lower level. Obviously, the lower unit must have fiscal resources and some independent decision-making capacity. Another performance dimension is an insistence on project preparation, demonstrating that minimum technical and economic standards are met.

54. In budget allocation the Bank is interested in the combined distribution--productivity goals and in developing the local institutional capacity. Given the conflict between productivity and redistribution in allocating funds to regions poor in both incomes and real resources, no a priori position should be taken on income weighting. Further, the political constraints may be severe and fine adjustments of allocations according to need may be quite impractical. Instead, Bank project staff might well emphasize performance criteria for specific projects and, where feasible, cost-sharing incentives.

55. For long-term institutional development, local bodies should have an effective voice in fund allocation among projects. One route emphasizing decentralization is to use essentially arbitrary allocation formulas such as a per capita base down to the local level. Of course,

technical support from above and some review with quality control would be necessary. The intent would be to give the local body as much autonomy, including the allocation of funds, as it could responsibly exercise. Any reduction in allocational efficiency because fewer projects are in direct competition relative to higher level decision-making could be off-set by increased local participation and long-term institution-building.

56. The longer run viability of local governmental and administrative units is not to be judged solely in terms of their effectiveness in utilizing resources allocated to them in some centralized budgetary process. In many if not all cases they have an equally important potential role as vehicles for the mobilization of local resources for developmental purposes through local taxation and revenues. Increasing reliance on local initiative and responsibility presupposes a correspondingly increasing desire and ability to capture a share of rising incomes for financing an expanding range of developmental activities.

57. The complex of issues surrounding local taxation and fiscal administration extend far beyond the scope of this paper. Nevertheless it is clear that they cannot be ignored in any consideration of rural public works programs. Of particular importance are financial provisions for adequate maintenance of completed structures and systems for assuring that the permanent benefits resulting from public works do not accrue primarily to private individuals in the upper income groups of the community. (These specific issues are discussed further in Part IV B below.)

IV. Issues in Project Design, Appraisal and Implementation

A. General Design Characteristics

1. Project Selection

58. Rural works projects are necessarily small-scale and geographically dispersed due both to the kind of construction and to the labor supply situation. Assuming that workers travel on foot daily from their homes to the project site (the real costs of their labor increase substantially if temporary living quarters must be provided), labor can be drawn from an area about five kilometers in radius to each site. In turn, the size of the work force that can be assembled at the site will depend on the density of settlement and the fraction of the labor force available for public works employment. Large scale projects in rural areas of some countries may not be adaptable to labor intensive public works construction because of the costs of assembling a large work force at a site.

59. Further, there may be technical difficulties and costs associated with interruption of the large scale works during the peak agricultural season; alternatively, retaining the labor force through the peak agricultural season could involve unacceptably high opportunity costs for labor.[1/] Hence, rural public works are typically small scale, or broken down into sufficiently small components so that they can be completed in one off-peak working period.

60. In concept, the small-scale components of a large scale sectoral project are attractive for rural public works. For example, in an irrigation project heavy equipment may be appropriate for large works such as dams and

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1/ In India, large scale labor intensive works in rural areas utilize migratory labor, often coming from distances of several hundreds of miles.

main canals while the widely dispersed distribution canals and field leveling could be accomplished efficiently with labor intensive techniques. In practice, coordination of schedules and technical design may be difficult.

61. The assets created in public works activities may be grouped in three categories: directly productive, economic infrastructure and social infrastructure. In the rural setting, the directly productive assets are mainly associated with land thereby increasing its productivity; examples are canals, terraces, and tanks - the physical structures for irrigation, drainage, soil and water conservation, etc. Economic infrastructure represents assets which are not direct inputs into rural production but whose supporting services increases the economic productivity of the community. Examples include roads, marketing, and storage facilities. Social infrastructure includes safe water supplies, waste disposal facilities and the structures necessary for providing social services such as schools, health clinics, administrative offices, and staff housing.

62. The distinctions among these three groups are analytically significant. The benefits of specific directly productive assets are traceable to individuals, usually land owners. The magnitudes of the benefits can be estimated more reliably than for the other two classes. Most important, recapture of a portion of these benefits is more feasible than in the case of either economic or social infrastructure. Specific charges or taxes tied to the benefits received can be levied. The benefits of economic infrastructure are more widely dispersed and there can be less confidence that any taxes will be in even rough proportion to the actual benefits. In general, the holders of fixed assets, especially

land, will receive most of the benefits. The benefits of roads and marketing facilities will accrue mainly to those with a marketable surplus of production above the household consumption needs. The distributional effects of social infrastructure are difficult to quantify, but are not independent of income. Excepting public water supply, the lowest income groups may receive little or none of the associated social service because they cannot afford the modest fees or are too poorly informed to participate.

63. The importance of creating economically productive assets in a public works program cannot be stressed too strongly. Only productive assets will induce a significant permanent demand for labor. Those countries likely to undertake public works are severely constrained in mobilizing resources for investment. Hence, public works employment is directly competitive with alternative productive investments. If the public works are not also productive, the poor of the future are impoverished for the sake of present redistribution. This is hardly a desirable strategy while highly productive potential projects exist.

64. There is evidence that past public works programs have accomplished fewer directly productive activities than seems justified from considerations of both employment generation and economic productivity.[1/] Two possible explanations are evident. (1) The directly productive projects may demand more technical capacity for design and supervision; e.g., the gradient of an irrigation canal is critical while that of an access road is not. (2) The distributional problems associated with the directly productive may be more self-evident, and hence a concentration on infra-

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1/ Digest Report,

structure may appear to be more equalitarian to program administrators and/or the local population. Whether in fact the potential distribution effects are inhibiting the construction of directly productive assets or not, Bank operational policy should seek means to minimize the conflicts between production and distribution objectives.

65. In a setting with a high man-to-land ratio, land-augmenting activities have the greatest potential for generating permanent employment. Experience has been reviewed[1/] suggesting that on average one permanent agricultural job followed from three to-five man-years of public works employment. In project preparation and management, attention comparable to that given the works construction is justified for fully exploiting the opportunities for permanent employment. The task will be complex because, excepting public works within a "new-style" rural development project, many of the required complementary inputs and policies will not be directly managed within the project. In particular, technical change in some settings may tend to reduce employment, either relative to the new potential or even relative to the previous. Such a reduction could follow from altered cropping patterns or cultural practices or from labor replacing mechanization.[2/]

66. The complementary approach is to minimize the flow to high income groups of that portion of the permanent benefits which accrues as

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1/ Digest Report,

2/ For example, a land conservation and leveling project might make tractors more attractive than previously because they could be operated more efficiently.

either explicit or implicit land rent. There are three ways of doing this: (1) Avoid public works projects in a situation of highly skewed land distribution. This could take the forms of selectivity among countries or geographically within a country. A region in which a thoroughgoing land reform had just been completed would be particularly attractive for starting a program of public works. While perhaps feasible in some circumstances, it is technically and politically difficult to build public works which will benefit only small farmers within an area. (2) Distribution among the workers of the land which they had improved. This is easier if the land was publicly held or had negligible prior value. Possibly, parts of large private holdings could be acquired before improvement or ceilings could be imposed on holdings of improved land. Such a course is bound to meet local political opposition, and similar efforts in the context of irrigation projects have had mixed success. (3) Recapture a part of the benefits to land holders via taxes or specific charges. Such action is generally attractive on developmental and distributional grounds, even if land holdings are fairly equal; it is almost imperative if land ownership is highly skewed. In practice, levies going to meet the recurring costs of keeping the works in repair and operation may be fairly well accepted; the recovery of initial investment costs will meet more opposition; and charges above the perceived benefits will be strongly opposed.

67. The linkages between economic infrastructure and employment are less direct and usually weaker than in the case of directly productive assets. The benefits of economic infrastructure are commonly viewed as being more broadly distributed, but there is no clear corroboration. Some benefits can be recaptured with fees, as, e.g., charges for

warehousing and marketing. However, the scope for effective intervention seems to be less than for directly productive works.

68. One example of social infrastructure with broadly and fairly equally distributed benefits is community water supply with the resultant public health effects. The benefits of structures associated with health and education will depend on quality standards, organizational design and other features which have been discussed in earlier policy papers.[1/]

2. Labor intensive design

69. Every opportunity for increasing the economically efficient use of unskilled labor should be explored, despite possible reluctance to vary designs and procedure by traditional governmental agencies. The latitude for increasing labor content will vary with the type of project. Earth-moving operations as in road construction or digging irrigation canals permit a wide range of substitution between labor and equipment inputs. On the other hand, building construction provides rather limited opportunities for varying the labor content. Of course, extremely labor intensive techniques which are not economically efficient even at very low shadow wage rates should not be used. However, evidence is accumulating steadily for the economic efficiency, at realistic shadow rural wages, of fairly labor-intensive intermediate technologies. For example, wheelbarrows are more efficient economically in moving materials short to moderate distances than either headbaskets or heavy equipment. For longer distances animal-drawn carts are likely to carry earth more

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1/ IBRD, Health Sector Policy Paper, March 1975; IBRD, Education: Sector Policy Paper, December 1974.

cheaply than motor trucks or scrapers when each is costed at realistic shadow prices.[1/] The indirect employment effects of intermediate technology are also favorable; simple tools and light equipment are well adapted for local manufacture using labor-intensive methods. In countries or regions where the appropriate technology is not yet established, a public works program should provide for the testing of promising alternatives, the supply of appropriate tools and equipment, and sufficient technical extension advice to ensure the efficient use of the introduced techniques.[2/]

70. In some cases the technical design of the structure or improvement should be adjusted to facilitate efficient labor intensive practices. For example, in constructing roads or conservation terraces on steep slopes, abundant labor suggests the use of stone retaining walls to support the sides of cuts and fills and thereby to minimize the required earthmoving. Less steep slopes not needing retaining walls but requiring much more earthmoving would be appropriate for construction with heavy equipment. Again, for lightly travelled rural roads, standards for alignment and surfacing derived for equipment intensive techniques may not be appropriate.

1/ IBRD, Study of the Substitution of Labor and Equipment in Civil Construction: various interim technical memoranda appearing in Phase III of that Study; Deepak Lal, Men or Machines: A Philippines Case Study of Labour-Capital Substitution in Road Construction, ILO, Technology and Employment Project, forthcoming.

2/ In the preparation for a possible rural access roads project in Kenya, considerable attention is being addressed to potential manufacture of tools and light equipment in local small establishments.

71. If the true social costs of labor and of present relative to future resources is fully recognized, it may well be desirable to design structures with shorter lives and increased maintenance relative to standard engineering practice. Also, some projects may lend themselves to progressive upgrading or reconstruction which is economiclly efficient in the circumstances. For example, an access road might be initially constructed to minimal standards, but widened and improved over several years.

72. Due to seasonal variations in farm labor requirements, most rural public works will be undertaken only in the off-peak periods when the opportunity cost of labor is low. Hence, projects must be designed to minimize the cost of interruption. Ideally, projects might be divisible so that a portion or section could be completed and put into service in each off-peak working period.

73. Relief efforts to meet rare catastrophes can rarely be organized as effective public works. The scale of effort and the lack of time for planning, preparation, and administrative build-up preclude the efficient mobilization of labor. However, relief for frequently recurring crises such as droughts and floods may be integrated with a seasonal public works effort. With an inventory of prepared projects and increased budget allocations, the public works can be extended in time and scaled up in numbers of workers. The management problems are minimized if there is already a substantial corps of administrators and supervisors. As regions with recurring natural crises frequently also have severe seasonal unemployment problems it would be desirable to design programs to meet both needs.

3. Wage policy

74. The level of wages, the incentive structure, and payment in kind are important issues in the design of rural works programs. Although there are contradictory arguments and special circumstances may dictate exceptions, a presumptive position on each is suggested by past experience.

75. There are welfare, incentive, and efficiency considerations in establishing the level of wages. The income distribution objective of public works is not served by wages either well above or sharply below prevailing rural market wages. Realistically, financial constraints will be operative in most programs and high wages would increase the individual gains to the newly employed but at the expense of those who could have been employed had the wage rate been lower. Given the diminishing social valuation on increments to individuals' incomes, the concentration of income gains among fewer workers reduces social welfare.

76. On the other hand, wages can be so low that income redistribution gains are reduced from the potential. Workers experience real costs in taking on public works jobs. The direct energy requirements for heavy manual labor, on the order of 1000 kilocalories per man-day, represent a significant private (and social) cost. Some workers will forego modest, but significant as a fraction of the paid wage, alternative earnings; if there is no alternative work, leisure would be preferred to heavy manual labor. Together, these represent the worker's "reserve wage," that wage at which he is indifferent whether he takes the job or not; only the wage increment above this level represents real income gains to the worker. Despite a diminishing social valuation of individuals' real

incomes, the maximum welfare gain for a given budgetary allocation will be realized at a wage level significantly above the worker's real costs in undertaking the work.

77. Another argument against too low wages concerns incentive and productivity. At low wages, recognizing that the wage income is usually shared with his dependents, the worker may not have sufficient nourishment for fully productive work. Further, if he feels that he is being paid an exploitive wage, he may not want to work hard and efficiently.

78. On efficiency grounds, wages can be too high for two reasons. First, a wage level above that necessary for motivated and efficient work reduces the physical scope and quantity of assets created, assuming fixed financial resources. Second, if the wage exceeds the going agricultural wage, labor will be drawn from productive, even if on a low level, agricultural employment. In addition to the resulting economic inefficiency, drawing workers off farms and pressing the agricultural wage upwards will tend to fuel political opposition to a public works program. During the peak demand season for agricultural labor, the usual sharply higher wage rates reflect high opportunity costs for labor. Typically, the social productivity of labor in public works is substantially below that of peak farm work and it would be unwise on efficiency grounds to meet the peak demand wage rates.

79. In conclusion, there is an excellent presumptive case for setting unskilled wage rates near the off-peak agricultural wage rate. The latter approximates the productivity in off-peak agricultural employment and

has some status as a "fair" wage among workers and farmer-employers. A significantly lower wage will be resented and will not call forth workers' best efforts; a higher will interfere with agricultural employment.

80. In a number of so-called "self-help" programs workers have worked for very low or no wages at all. In some countries there are traditional communal efforts to build and maintain local infrastructure such as roads and irrigation or flood control works. The concept is attractive as a means for mobilizing local non-monetized resources and and sometimes there is a strong political motivation for popular participation. Any judgment whether a "self-help" arrangement is desirable hinges on: the distribution of the benefits flowing from the completed works; and on whether the existing real income of the potential laborers would permit their low or unpaid work without undue hardships for them and their dependents. If the permanent benefits will accrue in rough proportion to the contributed labor (or other inputs) and no serious interim income reductions are involved, "self-help" is a useful means for carrying out public works.[1/] It is especially attractive for providing local public amenities which are valued by local people but which have low priority as essentially collective consumption items in central allocations. However, the Bank cannot support a "self-help" project in which the benefits of poor peoples' contributed labor are concentrated among well-to-do

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1/ Communal construction of public works, as in The Peoples' Republic of China, should not be confused with "Self-help" in the above sense, i.e., in the context in which it has been employed in non-socialist economies. The Chinese example illustrates self-help at the commune level, but individual workers receive work credits for their labor and all commune members share in the benefits from the completed works.

landowners. An important piece of evidence regarding actual income redistribution in the wrong direction is the extent of coercion involved in getting workers.

81. The incentive structure of wages is important for workers' motivation and productivity. Linking wage payments to actual output seems to be uniformly more successful than a time-based wage. Monitoring of work output is awkward managerially on an individual basis, but is readily managed for a moderate-sized work gang. In turn, the work gang exercises its own internal discipline. Dismissal upon completion of the daily norm rather than varying daily payments according to differential output seems to be preferred by workers and is more consistent with the income distribution objective. Of course, the daily norm must be reasonable and be recognized as so by the workers.

82. There are serious disadvantages to paying wages in kind, sufficiently strong that the practice is not advisable save in very special circumstances. The storage and transport of foodstuffs to a number of remote locations is a formidable logistic task, costly and requiring scarce administrative resources. After delivery to the workers, which may be delayed and at an inconvenient site, a part is frequently resold at a discount because the kind and quantity do not match the family's eating habits. Especially if unfamiliar foods from a foreign food aid program are provided, the real value to the worker may be much lower than the nominal.

83. Hence, if foreign assistance in the form of food is available and justified in terms of macro supply and demand, it will normally be

more efficient to sell the food in the port cities and to use the counterpart funds thereby generated to pay cash wages. Of course, the possibility exists for a local bidding up of food prices due to the demand induced by wages paid in a public works program. Not only would this erode the wage of those employed, it would affect more seriously those poor households unable to participate in the program. If the existing distribution channels are unable to meet the increased demand, measures improving transport and storage are necessary. In some cases, supplemental distribution facilities paralleling the existing markets may be advisable.

B. Project Appraisal Criteria

1. Economic Rate of Return and Distributional Considerations

84. Due to employment-income objective and the large share of project costs represented by wage payments, economic analysis of public works activities must address explicitly the income distribution implications. The general methodology recently set forth in Economic Analysis of Projects,[1/] expressly incorporates distributional effects; there are no intrinsic methodological grounds for differential treatment of rural public works activities. Whether an explicit social rate of return should be used to evaluate public works depends on Bank practice in other project areas. Hence there is no reason why rural works should not be subject to the application of criteria for acceptable economic rates of return to the same extent as Bank projects in other areas.

85. But the explicit calculation of economic rates of return and the setting on minimal acceptable levels is not to be mistaken for the basic objectives of project analysis. The system for such calculations now being developed in the Bank is intended to serve as a method for presenting in a convenient and comprehensible fashion the alternatives which an economy faces in marshalling its resources in pursuit of such fundamental objectives the alleviation of poverty, the promotion of growth and the reduction of income inequalities

> "...a systematic scrutiny of alternatives is at the heart of the appraisal process; it is not sufficient to select 'acceptable' projects whose benefits appear to exceed costs.... Consideration of alternatives is the single most important feature of proper project analysis throughout the project cycle, from the sector development plan through identification and preparation to appraisal."[1/]

1/ Bank Staff Working Paper No. 194, February 1975, p. 15.

86. The usefulness of economic and social rate of return analysis is enhanced by a clear recognition of its limitations. There will always be the all too familiar difficulties of quantifying benefits and costs as well as tracing their distribution among groups affected by the project. Moreover, any quantification will involve assumptions about the course of concurrent developments in the economic and social context within which the project is undertaken. For example, the traceable economic benefits of rural access roads--which are frequently a necessary but not a sufficient condition for rural development--may be quite low without express parallel development efforts. But in the context of a more comprehensive rural development effort their incremental benefits relative to no roads would be extremely high. Similarly, social infrastructure such as schools or health centers yield virtually no benefits unless the complementary staff and supplies are provided. Nevertheless, the systematic estimation of rates of social and economic rates of return is useful as a method for exploring alternative methods of construction, determining what range of activities should be included in a project, and generally clarifying the assumptions upon which any evaluation of a project is based.

87. Systematic inclusion of equitable considrations in project analysis through the calculation of social rates of return using distributive weights obviously adds to the difficulties of quantification. And such calculations are of limited value unless they are available for all or a large proportion of projects under consideration for financing. It should also be recognized that economic rates of return of the more traditional sort may in fact be satisfactory approximations to,or even

under certain circumstances exceed, social rates of return calculated with distributional weights even when a substantial proportion of project benefits accrue to the poor. Illustrative calculations using representative parameters suggest that the latter may be the case for those low income, labor surplus countries in which rural public works appear to be attractive instruments of rural development. The main effect of applying distributional weights to rural works projects in those circumstances may be a discounting of that portion of project gains accruing to the higher income groups. Such an outcome reflects the fact that public works wage income will leave recipients at about the "critical consumption level"--defined as the level at which the government is indifferent between increments in its own income (or investment) and in increases in private consumption. This underscores the importance of using social rate of return estimates for comparisons of alternatives and not simply as a means of introducing upward adjustments in rates of return to take account of ostensibly "favorable" distributional effects.

88. The technical aspects of project analysis and appraisal should not be allowed to obscure the substantive issues. Whether social rate of return calculations were undertaken or not, basic information on the amount and distribution of employment and asset creation should be developed. Few of the recent appraisal reports appear to provide estimates of employment to generate by public works activities within the project. Virtually no estimates are reported of the distribution of the benefits from the assets created.

89. Although the immediate, direct employment effects can usually be estimated with some degree of confidence they may be considerably less

important than the permanent employment generated and the distribution of the permanent benefits. An informed and realistic assessment of these latter is essential even though the quantitative estimates are difficult and inescapably subject to a wide margin of uncertainty. In particular, institutional and policy considerations and complementary inputs which are central to long-run project performance must be identified.

90. Appraisal of regional or national public works programs presents problems not posed for activities within either rural development or single sectoral projects. Given the variety of potential specific local projects and the de-centralized decision-making inherent in such a program, there will be considerable uncertainty as to the eventual composition of activities. Further, the effectiveness of coordination and management will influence enormously the performance of the program. Generally, there will be experience and data from a pilot stage of the program. However, this can not be used uncritically because the pilot projects may not be representative in terms of the local environment or of the level of management inputs that are feasible in a large program. Appraisal of a broad public works program must focus on the criteria, organization, and procedures which will produce local projects, and judge whether in fact these will yield high performance, on both productive and distributive objectives, projects in the country's economic, political, and institutional environment.

91. Under the best of circumstances projections of rates of return and distributive consequences of rural works activities will involve highly presumptive assessments. In the case of rural works components within large scale sector infrastructure projects or more integrated rural development projects, the range of uncertainty can perhaps be significantly narrowed. For broadly based programs for local, decentralized rural works, however, the magnitude and distribution of program benefits can only be based on inevitably rough expectations of results from activities whose precise character, location, etc., is determined during the course of the program. Operational guidelines and criteria for allocation of funds and for acceptability of specific project activities within the program must be carefully drawn to assure proper emphasis on productive as well as equitable objectives. But these can provide no more than a general framework; it would be idle to expect that local works project designs and decisions could be subject to any elaborate project analysis and rate of return appraisals. Bank appraisals of such program will, therefore, necessarily have to be based upon judgments regarding managerial capacity and institutional arrangements by only sampling evidence on the contributions to production and distribution objectives which individual project activities might be expected to make.

92. The most obvious implication of this is that Bank projects in support of rural public works will have to be designed with particular emphasis on monitoring and evaluation during the course of the project. Moreover, the focus of project supervision cannot be confined to observations on progress toward meeting established project targets; it will have to extend to obtaining information on more generally defined production,

distribution, and institution-building objectives so as to provide a basis for changes in the structure of on-going projects and in the design and suitability of future ones (cf. Section IV C below).

2. Maintenance

93. The frequent past insistence that public works funds be used only for new construction excludes possible high yielding reconstruction of old works and may result in inadequate maintenance and consequent low productivity of newly built facilities. The Bank position should be more flexible; depending on the circumstances, Bank objectives may be served by supporting maintenance in some projects, but not in others.

Regarding maintenance, the Bank has two main objectives:

1. that structures are maintained to standards consistent with high economic productivity; and
2. that the local administrative and financial capacity for maintenance be developed.

If a public works involvement would replace the maintenance which could be accomplished by a line agency or local institution, the Bank should oppose the public works route and reinforce the alternative institutions. On the other hand, assets new or old should not deteriorate so as to impair their economic contribution because local institutional capacity is lacking. In the latter situation, maintenance within the public works effort may be the best interim solution and acceptable to the Bank. Further, the Bank should emphasize transitional arrangements such as steadily increasing local responsibility which would work towards a permanent capacity and commitment for maintenance.

94. Reconstruction or catching up deferred maintenance of an existing facility is frequently an extremely attractive project, both in the share of wages in the initial expenditure and in the benefits yielded relative to the costs incurred. Bank operational policies should not prohibit or discriminate against such activities; the same tests should be applied as for new construction, subject only to the above reservation regarding impairment of alternative institutional capacity.

95. No fixed relationship between maintenance and original cost is possible. In a setting of high opportunity costs of investable funds, economic design standards, taking account of both initial and recurring costs, may lead to high maintenance needs. The basic philosophy of the public works approach is a repudiation of the "technical fix" as a circumvention of human and institutional constraints on providing continuing inputs and maintenance. These constraints must be addressed directly, and will require accordingly close attention from Bank projects staff.

C. Bank Project Management

96. The management of rural works components within a rural development project is inseparable from that of the larger project. Works components within an infrastructure project and project assistance to a works program have management challenges and problems in common with multisectoral rural development projects. All of these projects have characteristics which have notable implications for project management: (1) the activities within the project are numerous; (2) coordination with inputs, activities, and policies outside the project is complex; (3) project activities are small-scale and geographically dispersed necessitating decentralized and indirect implementation and control; (4) interactions with the institutional setting are important, even critical for project success; and (5) the transfer of project activities to continuing local agencies is essential for maximizing the long-run effects of the project. Each of these characteristics differ in significant degree, if not in kind, from the traditional Bank project context in which Bank project procedures have evolved. Hence, non-conventional emphases in project management are needed, some of which are already evident in innovative project areas, especially in rural development.

1. Preparation

97. Public works projects or components of projects must be carefully tailored to the social, political, and institutional environment as well as the physical and economic. Hence, no standard prototype, or small number of such, can be used for quick replication. Typically, project preparation will be extended and require much more staff time than does a conventional project. There will probably also be a fairly high dropout rate of projects

during the preparation and preappraisal stages. Hence, realistic, and large relative to the mean of all Bank projects, staff resources, should be programmed for the preparation phase.

2. Project Analysis Procedures

98. No major technical innovation is required in the appraisal of public works projects or components of projects. However, the systematic reporting of direct employment, especially of the unskilled, during the construction of the works is highly recommended. 1/

99. Both the quality of the available data and the inherent indirectness of project administration suggest changes from the standard style of project appraisal, particularly in the use made of economic estimates and on the importance of institutions and project administration. Appraisal will necessarily involve sampling procedures, implicit or explicit; direct estimation of the whole of the relevant universe of activities is totally infeasible. Estimates will frequently be subject to high levels of uncertainty. The importance of sensitivity analysis is further enhanced when the critical importance of institutions and political factors is admitted. These latter may be quite imperfectly understood and unpredictable.

100. In addition to thoughtful use of sensitivity analysis, projects should be designed with explicit attention to considerations of risks and uncertainties

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1/ Presumably these data are developed in preparing project cost estimates, and in evaluating technical alternatives. However, in only two appraisal reports of those reviewed were employment estimates reported systematically.

A project might be designed for achieving an acceptable but limited performance with some degree of confidence under the adverse range of expectations; if feasible, it might be modified in a more ambitious direction should more favorable circumstances develop. An example of project dimensions along which this might be done is in the extent to which implementation responsibilities are handed over to local agencies or government bodies. In general and at least for the foreseeable future, public works activities have an unusually high degree of risk, and expected performance should be discounted accordingly.

101. Given the decentralization and indirect management inherent in public works, project appraisal must assess the administrative arrangements and procedures with regard to the capacity to select, design, and execute specific local projects. It is not enough that good potential local projects exist; whether they can be brought to fruition is quite another question.

3. Supervision

102. Bank project supervision should be consistent with desirable internal project management. In particular, it has been asserted that foreign assistance to past public works programs has biased the programs towards an undue centralization via the stipulated project administration and control.[1/] This possibility can be avoided by reconciling Bank supervision procedures explicitly to decentralized administrations. For example, performance (actual works completion) as well as financial audit is essential in any de-centralized project. Bank supervision can utilize these audits with additional field verification by project supervisors.

1/ Digest Report.

103. Coordination of complementary activities is essential for fully exploiting the potential of public works; it is extremely difficult to accomplish consistently, especially as many complementary activities are outside the control of project managers. The Bank project supervisor may have few effective measures to remedy poor extra project coordination. Good project design can partially anticipate and avoid this problem by minimizing project dependence on coordination which is not reliable. However, in many projects key coordination measures will be essential for project performance, and in extreme cases lack of coordination may necessitate project suspension or curtailment of scope.

104. Rural public works are risky, especially as the distributive objectives weigh heavily in performance. The distributional effects, influenced as they are through complex institutional and political factors, are less controllable by project supervisors than are narrower physical performance. There may be no effective remedy short of project suspension. Again, many of the potential problems can be anticipated in a thorough preparation phase.

4. Evaluation

105. Effective evaluation and supervision are closely linked. In process evaluation is a primary input for project supervision. Evaluation should serve both the project management and Bank supervision. Current feedback can assist greatly in timely project modification or re-design in the event of changed circumstances or a mis-reading of the original situation.

106. Evaluation is equally important and difficult in the context of rural development projects. Substantial attention is being given to the development of evaluation procedures within rural development and the results should be highly relevant to public works projects as well.

V. Prospects for Bank Financing of Rural Public Works

A: Past Bank Experience and Current Activity

107. To date the bulk of Bank/IDA support for public works activities has been in the context of rural development and infrastructure projects. Only one project in support of an explicit public works program has been undertaken, and another was terminated in the appraisal stage.

108. Three projects approved in FY75 illustrate the potential for public works activities within some rural development projects: two credits in India, Rajasthan Canal Command Area Development Project (US$83.0 million) and Drought Prone Areas Project (US$35.0 million); and one loan to Mexico, Integrated Rural Development Project - PIDER (US$110 million). While exact shares cannot be estimated from the appraisal reports,[1/] it appears that public works activities constituted about 40 percent or more of each of these three projects.[2/] Each emphasized the employment of unskilled labor in project works. Not incidently, local cost financing represented a much larger portion than the average of Bank projects, ranging from 43 to 86 percent. In the two Indian projects most of the public works activities are directly productive, and in the Mexican project this category represents more than one-half the total.

109. Based on the appraisal reports of other projects, some potential public works activities seem not to have been undertaken with labor intensive means. For example, in a project in Jordon, N.E. Ghor Irrigation and Rural

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1/ Due to insufficient detail within the reported functional categories, and because contributed ("self-help") labor is not included in the project costs.

2/ See the attached table.

Development project (credit of US$7.5 million), activities in general amenable to public works construction comprise about three-fifths of project costs. Similarly, in the Philippines, nearly the whole of a project (Rural Development in Mindoro, loan of US$25 million) is devoted to public works type of activities. Despite the fact that in both countries seasonal underemployment is a serious problem, the reports do not review the potential for labor intensive construction of the works. Other evidence, equipment lists and foreign exchange requirements in the project, suggest that heavy equipment would be relied on. Of course, in any given project there may be good and compelling reasons for not using labor intensive methods. However, in these examples it is plausible that a substantial fraction - perhaps on the order of one-half - of the works could have been economically undertaken as a public works effort.

110. From a sample of FY75 agriculture and rural development projects, public works types of activities comprise a significant fraction, 15 percent or higher, of integrated or multi-sectoral projects. In some projects, explicit attention is given to the direct employment potential; in others it is neglected.

111. The Bank's only project to date in support of a country's public works program is in Mauritius. The original project design included basic infrastructure (roads, village centers, markets, water and health services) for 86 poor villages; bench terraces, fodder planting, and afforestation; and supporting technical and training services. Since project approval, high world prices for sugar and a construction boom in Mauritius stimulated by high incomes from sugar have increased sharply the price of land for projects works and have created an excess demand for

skilled construction workers. Consequently, project implementation has been modified to increase the labor training component and to reduce the land improvement.

112. Mauritius is quite atypical of the countries in which most of the Bank's financing for rural development takes place. The country's very small size minimizes the organizational problems of a public works program. There is practically no subsistence or smallholder agriculture in Mauritius; estate cultivation chiefly sugar, dominates the agricultural sector. Hence, the Mauritius project is not a general prototype for a rural public works program. The experience gained in this project is perhaps more relevant to the design of urban public works than rural. Management, both internal to the project and Bank supervisors, has responded constructively to changed circumstances and to improved knowledge; this example is important and relevant to all Bank involvement in public works.

113. Two projects now in preparation illustrate promising new directions for Bank support of rural public works. In Kenya, a major program for constructing rural access roads is being designed. Appropriate labor intensive techniques will be employed and Bank preparation has included the possibilities for local small-scale and labor intensive manufacture of tools and simple equipment that is consistent with intermediate techniques. In Korea, the possible Saemaeul Rural Infrastructure Project would support what is in fact a highly diversified public works program. The Saemaeul Program is notable for its local participation and de-centralized decision-making.

B: Prospects

114. The view permeating this paper is that rural public works does not constitute a sector of economic activity; rather it is an approach or means for undertaking activities within several sectors.[1/] Also, Bank experience to date is inadequate for establishing reliable projections for the feasible and efficient scale of support to rural public works. Hence, quantitative targets or guidelines for Bank lending for rural public works do not seem advisable at this time.

115. For the foreseeable future, Bank lending for public works programs will probably be constrained by the number of countries which wish to and are able to mount effective programs. More than two or three projects per year seems unlikely; the number may well be still fewer. In total volume of effective support for rural public works, components within rural development and infrastructure projects will represent much larger resources.

116. Despite the opportunities and a probable increase from current levels in the public works components of lending to the rural sector, the aggregate fraction will remain small. This is illustrated by the implications of hypothetical fractional shares: within agricultural and rural development perhaps 20 percent of projects lending will be amenable to "large", i.e., about one-third, public works fractions; in perhaps 40 percent the fraction might be one-fifth.[2/] The resulting share of agricultural and rural development represented by public works is about 15 percent.

1/ This view is similar to the policy position which has been adapted in the health sector.

2/ No normative significance should be attached to these distributions.

POTENTIAL RURAL PUBLIC WORKS COMPONENTS IN SELECTED PROJECTS

Project	Total Project Costs US$ m.	Bank/IDA Financing as percent of proj. costs	Percent local currency financing	Public Works Components (Percent)			
				Direct prod.	Economic infrastructure	Social infrastructure	Total
1. Mexico, PIDER	295	37	57	23	7	12	41
2. India, Rajasthan CAD	174	48	43	67	7	2	75
3. India, Drought Prone Areas	103	34	86	40	-	-	40
4. Philippines Mindoro	50	50	14	30	57	6	93
5. Jordon, N.E. Ghor Irrig.	17	43	0	39	3	16	58
6. Mali, IRD	19	42	0	-	18	2	20
7. Tanzania Kigoma	13	75	20	-	1	49	50
8. Nigeria Funtua Agr. Dev.	58	56	0	4	11	-	15

Sources: Project Appraisal Reports.

INTERNATIONAL DEVELOPMENT ASSOCIATION | INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT | INTERNATIONAL FINANCE CORPORATION

Yellow

OFFICE MEMORANDUM

agriculture + Rural Dev

TO: Mr. P. Greening, LCPA3

DATE: November 12, 1975

FROM: R. Echeverria, LCPA3

SUBJECT: Rural Development Working Paper No. II Forestry in Rural Development
Some General Comments

1. The paper succeeds in calling attention to an often neglected but crucially important subject for rural development, which is the fuel requirements of smallholders' household economies. As the paper points out, the bulk of the fuel requirements of small farmers has come from fuel wood, picked up from indigenous forests at no cash cost to the consumer. But as natural forest get depleted or replaced by crop agriculture, this free source of energy is becoming increasingly scarce and costly in terms of the time involved in fuel wood gathering or in terms of the cash outlays required to buy commercially produced fuel wood. Thus, most of the paper is devoted to exploring the prospects for larger investments in commercial fuelwood production for local consumption.

2. By placing most of the emphasis on the forestry--rather than energy--aspects of fuel wood production, the paper does not develop sufficiently several issues that are vital for the assessment of the role that forestry can play in rural development projects. A key aspect that should be developed further in the paper is the economic advantage (in terms of relative costs and benefits) of producing fuel wood in commercial plantations for household use, in relation to the cost of supplying other alternative sources of energy (i.e. coal or kerosene), although there are some general statements (paras. 2.3 to 2.8) about the problems that may pose the use of substitutes, these statements are not adequately substantiated and substitutes are quickly dismissed giving the impression that forest production for fuel wood consumption could have wider applications than it may be the case. It may be that in some instances fuel wood grown in land with a zero opportunity cost (not good for any other agricultural activity) could turn out to be cheaper from the farmer's point of view than alternative sources of fuel. But when land--which is a scarce production factor for a small scale farmer--can have other agricultural uses that permit a more profitable application of the household's abundant labor, it may well be that the opportunity cost of devoting this land to commercial forestry is greater than the cost of alternative (domestic or imported) sources of energy. Government subsidies, which are advocated in most of the production schemes suggested in the paper could only be justified in the selection of alternatives when the indirect benefits to the farmer and/or the country (i.e. soil conservation, landscape) outweigh the cost of the subsidy. These indirect benefits, however, are extremely difficult to quantify objectively.

3. In addition to a comparison with relative costs of competing sources of energy, forestry production for local consumption needs to be assessed against the opportunity cost of alternative uses of land. This aspect also is not adequately discussed in the paper. If, as in the

examples detailed in the annexes to the paper, the opportunity cost of land is zero, it means that the exclusive land vocation is forestry and the decision would be limited to determining if forestry production should go to local consumption or to industrial uses. If, as is generally the case in rural development projects,the land can have alternative agricultural uses, then forestry as a source of fuel for the farmer's household has to give greater return in terms of the use of the farmer's resources (land, labor and capital) than the other crop or livestock alternatives. It may well be that the farmer could end up better off producing and selling something else and with that income paying for his fuel needs. Again, possible government subsidies to reduce the private cost of forestry schemes are irrelevant in comparing different alternative uses of land, except when there are strong indirect economic benefits. In any case, the basic point is that the economic implications of going form a purely extractice activity (firewood gathering) to a productive one (forestry production) have not been systematically explored in the paper.

4. The analysis of supply and demand considerations is not very convincing either, since the paper takes a rather static approach. As natural forest get gradually depleted--the paper points out--, there is a growing unsatisfied demand for fuel wood and thus there is an urgent need to step up commercial production to meet that demand. Of course, with firewood as a "free" good, demand would tend to be very high, constrained only by the cost in time to gather the wood. But, unless the production cost gets heavily subsidized either directly by the government or by a parallel industrial exploitation of the forest in order to maintain a zero cash cost of fuel wood for the farmer, demand would drop drastically as price increases, and the farmer actively considers the economic advantages of using other agricultural (i.e. crop residues) or non agricultural substitutes. Although the paper notes, among other obstacles to small farmer forestry (para 2.15) the likely reluctance of the farmers to start paying cash for something that he always has had for free, the possible methods of meeting a static demand advocated by the paper (paras. 2.17 to 2.19) are not convincing.

5. A different aspect of forestry production which the paper also explores is small farmer participation in industrial wood production, oriented principally to large scale markets. In this section, more emphasis should be given to the fact that small holder commercial forestry for industrial markets is likely to make sense only in the context of larger rural development projects (probably in the forest land or in hillsides unsuited for cash crops) in which the bulk of the small farmer household income is likely to be generated from other sources. The main problem here is that the gestation period of a forestry investment (8-10 years) is too long to be of any assistance in the generally quite tight cash flow of small scale farmers. Also, forestry production is not labor intensive, and there is likely to leave substantial unutilized family labor that would have to be employed in other activities. Finally, carrying the risk of his investment and accumulated labor input over a period of 8-10 years until harvest would probably be incompatible with small farmers financial vulnerability, unless the could be adequately protected (against fire or other hazards) by some kind of effective insurance scheme.

Attach.

INTERNATIONAL DEVELOPMENT ASSOCIATION | INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT | INTERNATIONAL FINANCE CORPORATION

Agriculture

OFFICE MEMORANDUM

TO: See Distribution Below

DATE: November 11, 1975

FROM: Messrs. D. Stoops, D. von Samson and P. J. Brumby AB

SUBJECT: Integrated Broiler Production and the Use of Deep Litter from Poultry Houses for Cattle Feeding

The attached report summarizes our observations following a brief visit to North Carolina.

Attachment

Distribution:

Messrs. David Argyle
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PJBRUMBY:bb

Integrated Broiler Production and the Use of Deep Litter from Poultry Houses for Cattle Feeding

1. On October 20 and 21 Messrs. Stoops, von Samson and Brumby visited Wilkesboro in the North West of North Carolina to observe and discuss the role of intensive broiler production and associated beef cattle operations in the development of a previously poor rural community. A major force in local development has been Holly Farms, a major broiler producer.

2. Holly Farms was formed as a Corporate organization in 1961 as a result of 16 individual broiler producers, feed millers and chicken processors pooling their assets and forming the Company. The book value of Company assets in the subsequent 15 years has shown a forty fold increase. The Center of Company operations is at Wilkesboro, a town whose surrounding rural area has a history of poverty stricken, small farmer tobacco and corn growing. The present prosperity of the town and the surrounding small farmers now engaged in broiler production provides impressive evidence of the impact that company operations have had on local rural and urban development.

Integrated Broiler Production

3. Holly Farms is a very large integrated producer of broiler chickens and now markets about 7% of all broilers sold in the USA. Seven integrated and localized broiler complexes extending from Texas to Virginia are operated by the Company. Each complex comprises a number of company breeder farms which produce hatching eggs for use in company hatcheries. Day old chicks from these hatcheries are delivered to over a thousand grower farms, owned and operated by independent farmers. All feed and medication, technical advise and supervision are provided by the company, with the grower being paid a rearing fee which varies with broiler and feed prices, and which incorporates a factor for management performance. The current rearing fee amounts to about US$120 per thousand birds reared, an amount which must cover the farmers' labour and capital inputs (poultry shed and land). This sum is apparently sufficient to provide a strong incentive for farmers to participate. Day old chicks are nominally costed for bookkeeping purposes at US cents 12 each, and mixed feed at US$6/100lb. The resultant broilers average 4lbs at 8 weeks of age and have a feed conversion effeciency of about 1.9lbs of feed per lb of liveweight grain.

4. Eight week old broilers are killed and processed at 7 processing plants, the largest of which handles 200,000 birds per day and produces the packaged selected chicken cuts now so common in supermarkets. By packaging the product at the plant rather than at the retail outlet, controls over carcase temperature, moisture and bacteria levels are improved and economies of scale in byproduct processing and in the utilization of necks and backs are achieved. Distribution to retailers in Company owned and operated refrigerated trucks ensures optimum temperature control and minimal delays in shipment.

5. All feed used by the growing broilers is produced in Company mills and is subjected to quality control measures in the central laboratory. All mixing is based upon minimal cost feed formulation predicted by linear programming, using Company assessed nutrient requirements. All Company records and management data is also processed on an IBM 3,600 series 30 Computer. By sound recording and programming, detailed monthly performance records are available for each grower, breeding farm, hatchery and feed mix. Management control is thereby greatly facilited.

6. The management of Holly Farms suggest that the minimal size for an integrated broiler operation of the type described is determined primarily by the minimal economic size of the broiler processing facility. They suggest this should be at least 4,800 birds per hour, and preferably 6,000 birds per hour to give a weekly output of 200,000 birds of an average carcase weight of 1.2 Kg. There is reason to believe that in many countries much smaller processing units of 500 birds/hour can be viable. If however, a 200,000 bird per week estimate is used, a capital expenditure of about US$5 million would be required to provide day old chicks, mixed feed and processing facilities and an additional US$4 million would be required in capital for broiler houses and equipment. Start up capital required to initiate operations during the construction phase would be above US$2 million (details are available on request).

7. Two Hundred Thousand birds per week @ 1.2 Kg each is equivalent to about 12,000 tons of carcase meat a year. The investment cost required per ton of animal output (worth about $1,000) approximates $1,000 and interest and amortization changes would therefor approach $0.20 per Kg of meat produced.

The Use of Deeplitter from Poultry Houses for Cattle Feeding

8. Poultry manure, containing about 5.6% of total nitrogen, has recently attracted attention as a possible feed for ruminants. Approximately 50% of the nitrogen in the manure is in the form of unic acid which breaks down rapidly unless moisture levels are below 30%. Where deep litter systems of poultry raising are in use, the litter absorbs faecal moisture and conserves the nitrogen excreted. The mineral content of the excreta also provides the nutrient media required to enable a bacterial breakdown of the cellulosic material of the basic litter (usually sawdust or woodshavings) to the more readily digestible carbohydrates required by ruminant animals.

9. After six months of use poultry litter from broiler houses appears to contain about 24% crude protein equivalent and has been commonly used as a pasture fertilizer, primarily as a means of disposing of it. For this purpose its opportunity cost may be assessed at about US$15/ton on the basis of a 4% nitrogen and 1.5% phosphorus pentoxide content. Handling and pasture distribution charges are normally in excess of $15. Data on the energy density of poultry litter is presently extremely scarce.

10. In North Carolina we visited one farmer (Grant Menton) who is routinely ensiling poultry litter (with water added to give 30% moisture) in 600 ton harvestors for approximately 45 days and feeding the resultant ensiled material as 60% of the ration of fattening cattle. The remaining 40% of the ration is made up of cotton and peanut hulls (about 30%) and cracked milo (10%). Resulting gains approximate 3 lbs liveweight per day from an intake of 20-30 l s of total feed per head per day.

11. Ensiled litter is subject to oxidation and denitrification resulting in a rapid deterioration of palatability and feed value. Ensiling in trenches rather than upright silos is therefore impractical unless some 3 feet of the silage face can be fed each day. A 600 ton harvestor currently costs about US$28,000 complete with Angurs for moving feed. If 5 batches of litter are ensiled each year in each harvestor, the interest and amortization charges per ton ensiled amount to about $2/ton and the cost of collecting and trucking the litter to the site, about $15/ton.

12. Details on the yield of litter in relation to nitrogen build up are not readily available. Assuming the litter contains 24% crude protein equivalent after 2 batches of broilers, that some 80 tons of litter are produced from an 18,000 bird poultry house, and that the litter is used primarily as a protein rather than energy supplement for cattle and comprises 25% of the total dry matter fed, the ratio of chicken meat to carcase beef produced could approximate about 2:1. The ensiled litter can also be used as the main protein supplement for dairy cattle. For this reason it is of particular interest in those areas of the world where crop residues are relatively plentiful but protein feed for livestock in very short supply.

13. The most interesting question posed for the Bank by the technical and organizational success of the integrated broiler industry, and of the successful use of ensiled poultry litter as a cattle feed, is the extent to which this technology can be used to increase food output in selected areas of Bank client countries.

Agriculture & Rural

Mr. Robert S. McNamara November 10, 1975

Warren C. Baum Warren C. Baum

Non-Farm Rural Employment - Interim Report

1. The attached note has been prepared in response to the Board request for a report on "Non-Farm Rural Employment" (reference Mr. Green's question; Board meeting transcript, June 17, 1975).

2. The note is in the nature of an interim report. It summarises the current position as to Bank thinking on the subject of non-farm rural employment and indicates recent projects that are judged to have had a positive employment impact on non-farm rural groups. As indicated in the note, a full report on the subject is to be prepared during the next year.

3. Since the information contained in the interim report is of some interest, perhaps it might be sent to the Board in response to their request.

cc: Messrs. H. Chenery
M. Haq
R. Gulhati
M. Yudelman

GFDonaldson:mt

Nov 10
1975

THE BANK AND NON-FARM RURAL EMPLOYMENT

1. Extent, Growth and Location of Non-Farm Rural Employment

1.1 A large and increasing number of rural people in developing countries are finding employment outside of farming - in rural areas, villages and country towns. We might define this area, beyond the major cities, as the "non-farm rural sector". The major sources of employment in this sector are agro-industries, farm supply and service industries, rural commerce, small consumer good manufacturers, and public sector industries responsible for building and maintaining rural infrastructure. Impressive evidence of growth in the non-farm rural sector is seen in the expansion of villages and towns, which in several countries appear to be as rapid as that of the major cities; (see Table 1).

Table 1: Population Trends by Community Size in Six Latin American Countries 1/

Town/City Size Range 1970 (000's)	No. of Towns/Cities 1970	Population (000's) 1950	1960	1970	% Total for 1970	Growth Rate 1960-70
20 - 50	383	4,429	7,635	11,878	12.1%	4.5%
50 -100	122	3,658	5,623	8,523	8.7%	4.4%
100 -250	81	4,745	7,556	12,014	12.2%	4.8%
250	46	10,217	16,193	25,886	26.4%	4.8%
Big cities	7	16,885	25,881	39,869	40.6%	4.4%

Many of the small towns were villages twenty years ago; their populations have increased much faster than the natural growth rate, implying substantial net migration into them. The limited survey work that has so far been undertaken in these communities has uniformly pointed to a surprisingly diverse and growing

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1/ Argentina, Brazil, Chile, Mexico, Peru and Venezuela. There is similar evidence available for Korea, India, Taiwan and Turkey.

number of non-farm activities; the number and diversity are most marked in Latin America, as one might expect, but they are also significant in other regions, including Africa.

1.2 That the proportion of rural people not directly employed in agriculture should be growing is not wholly unexpected. The normal path of economic development involves the release of people from the pursuit of subsistence and their movement out of agriculture into other, often related, economic activities. This reflects the growing specialization of labor that has characterized the growth of all civilizations throughout history. In less favorable situations, it also reflects the continued growth of population which, in relation to a fixed land base, makes it necessary for an increasing proportion of people to seek their livelihood in productive pursuits other than farming. The forced movement of people out of farming need not be an unfavorable development effect so long as (i) agricultural productivity increases sufficiently to provide a supply of food at affordable prices, and (ii) other sectors of the economy experience sufficient growth to provide gainful employment.

1.3 Apart from releasing the food constraint so as to permit the general growth of industry and commerce, rural development programs directly promote the growth of industry and commerce in both urban and rural areas -- but particularly in what we have termed the non-farm rural sector. First, an increase of farm incomes leads to increased demands for locally provided consumer goods and services; second, rising farm output requires increased inputs of farm supplies and services, again, often locally supplied; third, increased farm outputs are associated with increased agro-industrial processing on both a large scale (for extenral markets) and a small scale (mainly for local markets); and fourth,

the building and maintenance of new infrastructure such as roads, irrigation works, schools, markets, storage facilities, electricity lines and water supplies, etc., creates new jobs. There is, of course, a two-way relationship, insofar as the growth of the non-farm rural sector benefits local agriculture by providing enlarged markets for farm output.

2. The Bank's Role

2.1 The Bank's rural development strategy recognizes the existence of a growing and potentially productive non-farm rural sector, although the Bank has not as yet isolated this sector *per se* for direct project investment (there is an exception in the case of agro-industrial projects, but the focus of these has, until now, been on increasing quality produce for export or city markets with little regard for employment effects). The primary emphasis in pursuing agriculture and rural development has been in expanding farm productivity. This has been based on the understanding that not only are a large proportion of rural people engaged in farming (in most cases the majority), but as just indicated, that the next largest group (those in the non-farm rural sector) are those indirectly involved in agricultural production, either through providing farm services or processing farm output. A considerable number of these rural development projects have in fact included direct investments in the storage, processing, or marketing of farm products or in the production of local inputs such as seeds.

2.2 It is especially notable that infrastructure investments associated with rural development programs usually support non-farm activities peripheral to agriculture more directly than they do farming itself. Thus improved roads directly benefit those involved in transport and trade of farm products, (who may or may not be farmers); electric power benefits those employed in or operating

small industries producing farm inputs or processing farm output; and the establishing of credit and input supply services and social services all create non-farm jobs. Further, investments associated with social components of rural development programs usually benefit farm and non-farm people in villages relatively equally. Thus, village water supplies, health clinics or village schools potentially benefit both groups. There are, in fact, few rural development project components that do not benefit non-farm groups, though generally the farming population is likely to benefit most.

2.3 The Bank has provided funds for a number of projects that directly benefitted the non-farm rural target group through increasing employment. As shown in Table 2, these include over the time period 1970-75, 15 projects with rural roads components, 18 with rural education, 9 with rural health and 13 agro-industries projects, as well as one or two water supply and rural electrification schemes. In addition, there have been some rural employment effects from predominantly urban infrastructure projects (not listed), such as the water supply projects for Mombasa in Kenya, Acra-Tema in Ghana, Guayaguil and Guayas Provinces in Ecuador, and coastal Tunisia; and the electrification projects in Kenya, Brazil and Ecuador. This listing does not include the 63 "new style" multi-sectoral rural development projects of the past two years which are expected to create added employment for non-farm as well as farm people in rural areas.

2.4 There remains the question as to what can be done in addition to the provision of infrastructure or direct investment in rural services as part of rural development projects aimed at raising farm production. There are three possibilities now being examined within the context of Bank research and policy work programs. First is the scope for extending credit and extension facilities

directly to the rural non-farm sector, and how this may be done in the context of Bank lending operations. Second is the balance of infrastructure investments between the rural areas, villages and towns situated in areas with growing non-farm rural population; rural development projects may be overly focussed, for example, on the small villages and rural areas - perhaps the larger villages and towns in the project areas require extra assistance from the projects. Third is the question of pricing, tax and subsidy policies and how they impinge on the relative growth of industry and commerce in urban and rural areas.

2.5 It is also recognized that regional planning, based on resource surveys and spatial analysis, and the development of new growth centers are of primary importance in extending economic development to non-farm rural groups. Consequently, these issues are receiving specific attention in the Bank's economic and sector work program. Additional research studies in this area are also proposed, and the Bank is providing technical assistance to member countries for regional planning, including remote sensing technology, as currently in Indonesia and the Philippines.

2.6 A paper will be prepared over the next year on the subject of employment creation and income generation for non-farm rural people, based on studies currently under way. This paper will include a survey of evidence on the scope for expanding employment in this area and the types of activities involved, including: agricultural linkages, both forward (processing, transport) and backward (manufacture of tools, input supply); mining and forestry development; small scale rural industries; decentralized large scale industries; and, rural public works and infrastructure programs.

Table 2: Projects Directly Affecting Non-Farm Rural People 1970-1975

Country	Project Name	Loan or Credit No.	Total Project Cost	Rural Component	Bank/IDA Financing
Rural Roads					
Senegal	Highway Project	198 SE	2.5	2.5	2.1
Tanzania	Highway III	265 TA	9.5	6.5	6.5
	Highway IV	507 TA	12.5	5.5	10.2
Ethiopia	Highway V	332 ET	22.0	22.0	17.0
	Roads VI	552 ET	54.7	32.0	32.0
Malawi	Highway II	523 MAI	12.5	3.0	10.0
Swaziland	Roads II	1108 SW	9.9	6.0	7.0
Zaire	Highway III	536 ZR	40.3	19.0	26.0
Mali	Highway II	383 MLI	-	6.0	8.3
Sierra Leone	Highway I	710 SL	52.1	1.5	2.3
Upper Volta	Rural Roads	579 UV	8.5	7.5	7.5
Mauritania	Highway III	519 MAU	13.7	3.0	3.0
Yemen PDR	Highway II	560 YDR	31.8	8.0	15.5
Paraguay	Highway IV	1059 PA	20.0	7.5	14.5
Brazil	Highway V	1075 BR	276.0	30.0	110.0
Rural Education					
Chile	Vocational Training II	666 CH	3.0	0.8	1.5
Costa Rica	Education I	915 CR	9.4	2.21	6.2
Honduras	Education	954 HO			
	"	452 HO	8.66	6.88	6.0
El Salvador	Education II	1007 ES	24.0	1/	17.0
Dominican Rep.	Education II	1142	13.54	5.0 2/	8.0
Guyana	Education II	544 GY			
	"	1106 GY	18.9	1/	12.0
Tanzania	Education III	232 TA	4.7	4.7	3.3
Upper Volta	Education I	430 UV	3.6	3.6	2.8
Mauritania	Education	459 MAU	4.6	1/	3.8
Ethiopia	Education IV	553	34.68	11.5	23.0
Sudan	Education II	547 SU	10.0	1/	10.0
Somalia	Education II	511 SO	9.3	5.5 2/	8.0
Swaziland	Education	518 SW	7.1	1.5	5.0
Dahomey	Education	N/A	5.5	1/	4.0
Lesotho	Education II	497 LE	8.14	1/	4.0
Rwanda	Education	567 RW	9.0	1/	8.0
Rural Electrification					
India	Rural Elect.	572 IN	114.1	114.1	57.0

Country	Project Name	Loan or Credit No.	Total Project Cost	Rural Component	Bank/IDA Financing
Rural Water Supply					
India	Uttar Pradesh Water Supply & Sewerage	1009 IN	72.0	29.3	40.0
Rural Health					
Kenya	Population	468 KE	38.8	8.8	12.0
Tunisia	"	238 TUN	7.7	3.6	4.8
Egypt	"	437 EGT	10.5	4/	5.0
Jamaica	"	690 JM	3.0	0.4 3/	2.0
India	"	312 IN	31.8	4/	21.2
Indonesia	"	300 IND	33.0	4/	13.2
Malaysia	"	880 MA	14.5	0.5 3/	5.0
Iran	"	928 IRN	33.4	20.3	16.5
Philippines	"	1035 PH	50.0	12.8 3/	25.0
Agro Industries					
Korea	Agric. Processing	994 KO	20.0		13.0
	Seeds	942 KO	22.8		7.0
Philippines	Rice Processing	720	20.9		14.3
Bangladesh	Cereal Seeds	410	10.6		7.5
India	Grain Storage	267	15.0		5.0
	Bihar Wholesale Mkts.	294	23.3		14.0
	Agric. Mysore Mkts.	378	12.0		8.8
	Apple Processing	456	21.7		13.0
Iraq	Grain Storage I	925	92.0		40.0
Yugoslavia	Macedonia Industries	894	62.0		31.0
Brazil	Grain Storage	857	75.0		30.0
	Agric. Export Indust.I	924	135.0		54.0
Ethiopia	Coffee Processing I	290	10.3		6.3

Source: World Bank Appraisal Reports.

Note: 1/ Figures for Rural education are not specified but are obviously quite high since the project is heavily weighted toward rural education.

2/ Approximate

3/ Construction cost only. Excludes equipment and other related costs.

4/ Not specified.

Agriculture

November 5, 1975

Dear Mr. Tainsh:

Thank you for your thoughtful letter of October 14 and the attached article. As you may know, we share your concern about the wastage of basic foods after they have been produced at farm level. Recently, we have been attempting to increase our efforts at improving storage systems and food delivery capacities in developing countries within the portfolio of our expanding agricultural and rural development projects. In Asia we are supporting a number of grain storage operations, as well as specific projects in processing and packaging of milk and fruits. In Mexico we recently helped finance a nationwide program for integrated rural development, the PIDER project, within which there is an important component for small-scale, village-based storage systems. You may be interested to read a note which was recently prepared in our Rural Development Division on this matter. I have enclosed a copy of it.

Sincerely yours,

J. Burke Knapp
Senior Vice President, Operations

Enclosure

Mr. A. Ramsay Tainsh
Östermalmsgatan 61
S-114 50 Stockholm
Sweden

LEChristoffersen:jo'd
November 5, 1975

A NOTE ON THE FOOD STORAGE PROBLEMS

Last year's World Food Conference brought out some of the problems associated with the storage of food. While the need to produce more food in developing countries was emphasized, perhaps not enough emphasis was given to more effective ways of maintaining the value of farm production through the interrelated systems of storage, processing and packaging.

On the difficulties in quantification, considerable controversy exists. Estimates vary from 10-15% in the case of rodent damage to India's harvested grain. Michael Lipton of Sussex University, for example, questioned the 50% figure of India (due to rat damage).

Lipton, after considerable study, argued that storage losses for basic grains are probably less than some of the high figures cited at the World Food Conference. He mentions that small farmers over the centuries have devised ingenious systems to preserve their basic livelihood (cow dung on baskets, which acts as an insect repellent and disinfectant, as well as deep burial of grain in pits instead of above ground storage). While not wishing to take sides in this quantification issue, the wide divergence of expert opinion illustrates the need for considerably more empirical analysis in quantifying the food wastage problem.

We also understand that considerable controversy exists around the problem of "where to store". A lot of effort has gone into devising improved on-farm storage systems on the grounds that this is where 75% or more of all losses take place. Others feel that the costs of trying to improve millions of small farmer storage systems are prohibitive. These groups work with village-level storage systems, such as the system devised in Mexico, which is being supported by the Bank.

The Mexican Government has taken a series of steps in recent years to reduce grain losses at the farm level and to improve and widen the availability of basic foods to its poorer urban and rural population. The instrument of this effort is the Government Agency, CONASUPO, which has these functions:

First, it supports the building of a large number (1,600) of small village-level grain storage warehouses, holding an average of 100 tons of basic grains, mostly sorghum, corn and beans. CONASUPO's program concentrates on village-level rather than on on-farm storage because of small warehouses' greater effectiveness in controlling losses. More important than just the warehouse facility is CONASUPO's grain education effort which provides each village with a training program for persons from that village in stacking, bagging, testing and pest control, all

designed to minimize losses once the grain has been harvested. This has been a singularly successful effort, becoming a model for other countries. Perhaps the most critical person in the system is the Grain Analyst who is in charge of receiving and analyzing (humidity level, foreign matter, etc.) the grain, storing it, paying the farmer, and, in some cases, selling inputs (e.g. fertilizer) and staples (via warehouse stores). The analysts are nominated by the community (the candidates must have at least a 6th grade education) and are trained in a three-month course in one of the 20 CONASUPO training centers. About 2,400 analysts have been trained and 1,700 are actually working as the chief grain analysts or assistants in the warehouse centers.

Second--and as important--are CONASUPO's retail activities. It now operates some 8,000 urban and rural small stores where basic foods (canned milk, flour, sugar, corn, beans, etc.) are sold at fixed prices. The poorer groups especially benefit from this program. Tied to it are increasing investments in processing and packaging in simple 2-4 lb. poly bags.

Finally, a major part of CONASUPO's success in this effort to reduce losses can be attributed to CONASUPO's systems approach. The village warehouse is only a small part of a national marketing and training grid integrated from farmers to consumers.

Rural Development Division
October 1975

Agriculture + Rural Dev

Mr. Montague Yudelman

October 31, 1975

D.C. Pickering

OED Performance Reports

1. As requested in your memorandum of September 16, I submit below my interpretation of the lessons to be learnt from the conclusions and recommendations of recent OED Performance Reports. Of the nine allocated to George Darnell and me, only seven were available as of October 30[1/]. I understand that Pierre Courbois has commented on Credit 105 - The Kenya First Smallholder Agricultural Credit. In the interests of brevity, lessons common to several projects are lumped together. Most are obvious, at least on reflection. However they are sufficiently important to warrant emphasis and reiteration to all staff concerned with future identification, preparation, appraisal and supervision of agricultural and rural development projects financed by the Bank.

2. First, it is difficult to predict such things as yields, cropping patterns, production and incomes with accuracy. Important impediments are the complexity and interaction of physical (natural resource) and socio-political factors, and the narrow data base normally available at most stages through appraisal. Examples include agrometeorological information, relevant agronomic experience, and sociological data. Such are particularly important components of the rationale for yield and production predictions upon which rate of return calculations are based. When they are inadequate the validity of such calculations immediately comes into question. It may be argued that the conclusions of OED Performance Reports in this respect have been drawn prematurely or on inadequate evidence, see paras 3 and 4 below; nevertheless, the obvious lessons are that since such basic material is frequently unreliable or lacking:

a) The greatest care should be taken in making judgments in these areas at all stages in the project cycle;
b) judgments should be fully supported by their rationales;
c) the conjectural nature of these judgments should be recognized by management.

3. Of the projects under review, most made inadequate provision for monitoring and evaluation. The importance of collecting, processing and interpreting base-line data and continuation through project implementation appears generally to have been either neglected, or the difficulties of carrying out such activities have been incompletely appreciated. Experience

1/ Kenya Tea I - Credit 64, Kenya Tea II - Credit 119, Uganda Tea - Credit 109, Malawi Lilongwe Agricultural Development Program Phase I - Credit 113, Sudan - First Mechanized Farming Project - Loan 556, Malawi- Shire Valley Agricultural Development Project - Credit 114, Tunisia Cooperative Farms - Loan 484 and Credit 99.

for example at Lilongwe, shows clearly that data collection on such conceptually simple items as yields is difficult and expensive. Extrapolation of this experience to conceptually more complex items such as farmers' attitudes to change implies substantially greater difficulties and expense. The lesson here is that monitoring and evaluation of agricultural and rural development projects is unlikely to be either easy or cheap. Systems require very careful design if they are to be meaningful. Further, because such systems are likely to be costly, their inclusion in projects needs to be actively "sold" to borrowers early in the project cycle.

4. While it is possible to transplant designs and practices from one project to another of like kind within and between countries, there is a very real need for flexibility and modification to meet different or changing circumstances. This lesson may be extended to the need for flexibility in the interpretation of appraisal reports and other loan documents for most agricultural and related projects. Too often it appears that borrowers and the Bank, including the Operations Evaluation Department, regard project appraisal reports as blueprints to be followed rigidly and without regard either for changing circumstances, or the fuller understanding of vital factors arising from the intimate experience of project management with the situation on the ground. At the same time, important decisions on changes in project direction should only be taken after careful consideration of the facts of the case. Further, the rationale for proposed changes should be provided and discussed with the borrower and project management to ensure full understanding by all parties.

5. Most of the reports reviewed either implied or referred explicitly to the long time scale, frequently in excess of a decade, needed to obtain a meaningful reading of project effects. This applies to such apparently simple parameters as production increases from rainfed annual crops. In such cases, climatic variations play a large part, in addition to factors such as the development of delivery services, farmer responses and so on. It follows that an even longer time frame may be needed to obtain a reading on social changes occurring as a result of project actions, since social change in many cases will be fueled by production increases. The lesson here is perhaps most relevant for those not accustomed to biological vagaries or human reactions to changing circumstance.

6. Other important but rather obvious lessons drawn from the report under review are:

i) The need for a measure of continuity in the staffing of supervision missions.

ii) The importance of selecting or promoting the development of a sound institution for the implementation of projects.

iii) At a very early stage, the identification of valid sectoral objectives and the subsequent design of activities to meet such goals.

iv) The need for care when contemplating a move from a comparatively simple phase I production oriented project to subsequent, more comprehensive phases. Factors needing careful scrutiny include particularly, the capability of the natural resource base to pay for social development and the fact that ultimate reintegration of project units into political and administrative structures becomes more difficult with the passage of time.

DCPickering:hrv

cc: Mr. Darnell

Agriculture

Mr. M. Yudelman

October 30, 1975

Pierre A. Courbois

OED: Agricultural Credit Programs
Comments on Second Draft (Recommendations)

The second draft is easier to read than the first, shorter but still too long; many statements and judgments are based on sheer and questionable assumptions and data readily taken for granted. Conclusions and recommendations are not fully consistent with or supported by the text. Most recommendations are not innovative - how they can be put into practice is another story!

Recommendations

Increasing productivity on medium and large farms.

(1) Distinguish permissive and promotional projects.
The relationship between this recommendation and proposals made in 7-49 is not clear. The term "permissive credit projects" may raise many eyebrows. In any case, the distinction may not be so easy to make. All projects should have production objectives and additionality should be anticipated, although in most cases its level cannot be assessed. In the late fifties and early sixties, the Bank was not financing replacements; would the permissive credit projects accept such operations which are current in agricultural credit institutions?

(2) Eliminate all farmer subsidies in permissive credit projects.
It is clear that this is or should continue to be an objective of the Bank. The elimination of all farmer subsidies in permissive credit projects is, however, a pious and unpracticable measure. The Bank approach on a case by case basis seems to be the only sensible and possible one for all projects. In fact, the report does not make a case for excepting from the rule the promotional projects which may yield higher returns than the permissive projects. Under the same heading, the report should also state precisely whether interest rates should be adjusted to take care of inflation.

(3) Reduce farm planning and technical assistance for permissive credit projects.
Savings in the present routine work of farm budgeting can be made, for instance, where it involves purchase of farm machinery by medium- and large farmers. The problem is to define the projects when farm budgeting would not be required.

Finally, there is little technical assistance given in most agricultural credit projects with the exception of livestock projects. Efforts could well be concentrated wherever there is clear need for technical assistance. This raises, however, another question which is whether the organization of technical assistance should be built in the credit system or should be outside the credit system. If the system of credit is self-contained, only borrowers benefit from technical assistance. In addition, the credit institution runs into the problems of effective use of the technicians, of availability of research and high costs. An independent system has also weaknesses, but may have a wider impact, more especially on small and medium farmers.

(4) Substitute para-technical for professional staff on loan processing assignments.
No comments.

(5) Expand the research component in or associated with promotional projects.
The statement quote"lending for the adoption of new technologies has gotten ahead of the availabilities of those technologies"unquote is quite questionable. In any case, the attention should be drawn on the fact that research and testing in the field are long processes, and phasing with a credit project seems an impossible task. Where there is a clear need for research, it seems better that the Bank give its support either in the form of a special project or, if the size of the research is small, in the form of a sub-project which does not interfere with the lending operation. Only in rare exceptions can it be anticipated that research undertaken in relation with a credit project will benefit this project.

(6) Develop low cost security systems.
This, again, is a pious suggestion. There are few alternatives to classical security instruments like the mortgages (land and chattel). Rather than, or concurrently with crop insurance schemes and sub-loan guarantees (It would have been of interest to know what are the etc.. etcs. which make believe that there are many alternatives.), the report could also have recommended an improvement of the usual security instruments (land and chattel mortgages including mortgage on standing crops) and related procedures (search for title, establishment of title, registration of mortgage-enforcement and reductions of costs for the farmer). No mention is made of the high costs of crop insurance schemes, sub-loan guarantees and related management problems which make it very difficult to put them into practice. There is clearly a problem of security for loans, but the essential has not been said in the present case as in many other reports. Excellent

repayment records may be related more to good organization and management without undue political interference than to collateral or any type of security. Most credit institutions are poorly organized and managed in terms, for instance, of relationship with and general knowledge of farmer-borrowers, management of farmers' finance repayment capacity and collection mechanisms. Modern techniques permit an accumulation of information on borrowers which is not yet used in the institutions supported by the Bank.

Collateral is, however, necessary in many cases, more especially long-term credit. Well-to-do bankers consider it rightly both as a means of collection of last resort and protection for the borrowers themselves.

It is not clear (last sentence of (6)) what are "low costs screens for eliminating unprogressive applicants".

(7) Expand portfolio of medium farmer projects.

No comment of substance. There might be more nuance in the expressions or qualifications, e.g. "unattended strata" and "extraordinary attention". The recommendation that "customary agreements, with other donor agencies which exclude the Bank from the medium strata, be dropped" is welcome. Another suggestion could be made that customary disagreements regarding terms and conditions of loans be discussed with other donor agencies.

(8) and (9) No comment of substance. Recommendation No. 9 is particularly welcome because there is not yet any satisfactory low cost and effective monitoring system. The Bank might look towards the work of "Centers of Management" established by farmers themselves in some developed countries.

Developing Financial Markets - Further Measures.

(10) Press more firmly for higher farmer interest rates.

No comment of substance. It should, perhaps, be stated what the Bank is aiming at; such as positive rates.

(11) Build the savings function into credit programs.

As such, this recommendation is not acceptable because it may not be suitable in all projects and all countries. Not all governments may be persuaded that it is in their interest to create savings functions in credit agencies which may compete with specialized government agencies and result in a wastage of human and financial scarce resources.

General banking services (such as for handling remittances, current accounts and deposits) seem to be needed by rural people more than savings facilities. Experience has shown that raising of savings is a costly proposition for meager results. In addition, while substantial amounts of funds can be raised from a number of rural people (merchants and mostly civil servants) it is hard to believe (experience supporting this) that significant savings can be raised from farmers. Small farmers make insignificant, if any, cash savings and larger ones have access to savings mechanisms or have investment opportunities.

The mobilization of local resources should undoubtedly be advocated but the recommendation should be better measured, take care of available experience and assume a change in many government interest rate policies (in fact, mentioned in the text). The recommendations might include some mention of the cooperative way of mobilizing savings.

(12) Harness the capacity of private banks and cooperatives.

This has, for a long time, been the Bank policy and is not questionable. Some reservation is justified and the attention drawn on the following: Many Bank reports seem to take for granted that private commercial banks are acceptable channels for credit without giving any supporting reason. The only reservation is usually cognizance of their lack of expertise in the agricultural field. A cautious approach seems to be warranted. Commercial banks are not always managed effectively; all are business-minded and accordingly very much interested in dealing with clients of higher standing than small farmers, even though they are given significant incentives. As they are concerned with the farmers' repayment capacity, they may well be in line with Bank production objectives but it would be surprising if they were very much concerned with intensification, additionality, equity and other Bank pre-occupations. The nature of the commercial bank resources is another constraining factor to their involvement in agriculture. The experience in developed countries has shown the little impact of commercial banks in the small scale agriculture sector and in long-term investment loans. The experience in developing countries is negligible.

Pre-appraisal and appraisal activities.

A criticism in the report might have been anticipated on the usually small role played by government concerned in the identification and preparation of projects, and on efforts made or that should have been made by the Bank to shift identification and preparation to the countries themselves. If the shift were possible, that would save a considerable manpower in OCP and the Bank and raise less issues at negotiations and during implementation. The problem is not without a satisfactory solution and some good but restricted results were achieved.

(13) Expand certain identification analyses.
(14) Expand the sensitivity analysis.
(15) Develop a farm strategy sheet.
No comments.

The recommendation 13(2) may, however, be difficult to carry out because the related information cannot be secured easily.

With regards to channel margins, the experience shows that the margins considered to be adequate by the Bank are usually too small to cover costs and defaults (as mentioned in the text of the report).

(16) Improve some other appraisal practices.
16(1). The financial rates of returns to the farmer's equity are more often meaning-less because as they are calculated they represent returns to additional family labor and often a token amount of capital. (For a large scale farmer employing hired labor, the problem is different and FRR calculation may make sense.). In fact, in small farmer projects more attention should be paid to the incremental cash flow compared with the additional labor required than to any financial rate of return.

16(2)(3) No comments.

16(4) This recommendation seems to be extremely difficult to implement.

16(5) Is standardization meant for all countries, in which case there is a problem of consistency?

(17) Expand supervision of farm and institutional performance.
It should not be said that "the job would be simplified to the degree that effective monitoring systems are functioning"; in fact, assessment of achievement would not be possible. OED has built an experience in this field.

(18) Make available professional technical support for mid-course modification.
No comment.

(19) (20) (21) Staffing.
No comments.

Assessment of channels.
No recommendation has been made on the appraisal of credit channels with regards to both managerial capabilities, financial management and position which sometimes leave much to be desired in appraisal supervision and completion reports.

Assessment of demand.

The report draws the attention on the difficulties of assessing the demand. No satisfactory method has been evolved to evaluate and forecast demand. This might be a field of investigation where studies of farmers' behaviour might have their place.

PCourbois:sj

Agriculture

Mr. M. Yudelman

October 30, 1975

Pierre A. Courbois

OED: Agricultural Credit Programs.
Additional Comments - Points of Detail

Preface 5: What is agricultural credit per se? There are apparently multiple viewsmin this respect.

1.3: 1 or 2 lines missing.

2.17: The statements made about the number of farmers reached may be correct but they are nevertheless misleading. The institutions supported by the Bank were not the only ones providing credit to farmers, more particularly in Morocco where over 300,000 farmers were at one time receiving credit through the Ministry of Agriculture and the SOCAP.

2.34: The criticism may be warranted but the bias reflected a quasi-unanimous approach of the Bank staff and a general belief outside the Bank that it was the right direction. The shift is recent and in many developing countries more lip-service is paid to the small farmer problems than action taken in their favor. The term "ancestral" may not be the most suitable in the circumstances.

2.36: The discussion about small farmers versus large scale farmers is quite sterile, as long as a typology of farmers or farms has been developed. It does not seem that the present connotation is very precise. In the Bank, the problem of ancestors was, in fact, not only the general bias in favor of categories of farmers (who seemed more able to adopt new technologies and develop production than others), but at that time the outstanding problem of suitable channels and supporting services which could not handle multiple loans effectively or provide the services required.

2.43: The assumption made that most of the borrowers could have found longer commercial terms, for some items is not supported by any evidence, i.e. Morocco, Uruguay, Philippines. In this connection, no reliable information is available for Mexico and Pakistan.

III. Program Impact: I have serious doubts on many of the assumptions and statements made in this chapter. I feel that attention should be drawn by the report (at least more than actually done) on the possible high margin of errors in the information and data collected and the evaluation of achievements.

C 3101 etc. Problems of substitution: The criticisms made by OED imply a bad use of farmers' or others' savings. This is not supported by facts. In this matter, the farmers' psychology is also ignored. Many farmers (especially the small ones) would not, in any case, risk their own funds without an outside support, and credit is the main factor contributing to the mobilization of idle funds.

IV A. Financial viability of credit channels: For no channel, including Mexico (sec. 4.9 and 4.16), operations under Bank funds have been profitable, risks being taken into account, and the adverse effects of inflation being discounted. Figures of costs are usually underestimated, as mentioned further in the report.

As far as Morocco is concerned, some figures of Table 16 are questionable, e.g.

1.	no change	
2.	Interest rate charged to channel	: 5.5 ? (instead of 5.3)
3.	Gross margin	: 1.00
4.	Administrative costs	: likely between 5.00 and 5.50 rather than 4 which is the average cost of lending to large scale farmers and institutions.

The cost of lending to institutions (Coops, Government agencies) is considerably lower than the cost of lending to farmers. (The cost for CLCA is about 20% higher than the cost of lending to large scale farmers.)

5. Default: 0.35 instead of 1.5
The figure of 0.35 is not actually representing defaults but provisions built-up over a period of 12 years to meet defaults. The provisions are considered to be adequate. Actual defaults and related write-offs over the period are less than DH 200,000, e.g. a negligible amount compared to loans issued or outstanding (in 4-6 the term "write-off" is improper). Surprisingly, the computed interest rate chargeable to farmers remains the same (13%) despite the above discrepancies.

It is clear in Table 16 how the rate of 16.2 is arrived at; it is not any more under 4.16.

4.20: It is correct to say that the Bank has consistently under-estimated the required adjustment. It might be said that this error was committed mostly during recent years because of inflation and the smaller size of farms involved.

4.24: The statement as to how the contribution of banks should be determined is not clear.

4.30: It may be of interest to know that as of August 31, CNCA's staff numbered 1,315, of which 960 are field staff. This is an example of the acceleration (often dangerous) in development which may take place in agricultural institutions, always after a long gestation time.

4.37: "The screen was not investigated". This statement does not apply in all cases. In addition, the behavior of public banks is strongly influenced by political interference and Government financial support. Hence, a behavior which may not be comparable to that of commercial banks.

4.38: The assumption made that if the Bank and Government sources were closed long-term lending by commercial banks would practically disappear, is probably largely correct and may make the Bank's present efforts to mobilize them look quite futile. It is highly doubtful that long-term deposits, even though the level of interest rate is increased substantially, can be a significant and moderately costly source of agricultural credit in developing countries.

Credit and technical services. p. 141 and following: It is difficult to draw a conclusion from these pages. My feeling is that technical services should be available to all farmers, and by priority to those covered by Government schemes, projects or programs, including those with a credit element. Provision of technical assistance and various supporting services should be kept separate from the credit functions. There have been justifications for integrating technical functions, agricultural extension services, and various other supporting services in credit agencies. More often it was because there was no alternative, but this is not a satisfactory and permanent solution. It may slow down the development of Government services or services which are developed in a number of countries by the farmers themselves. The latter have proven to be very effective.

5.12: Financial return to the equity investment omitted in appraisal reports: The matter was discussed and the calculation was deliberately and rightly omitted. It is an indicator which is far more misleading than the current one.

5.32: The criticism regarding the quantum of participation of commercial banks is not clear to me.

5.35: (etc.): There should be some common understanding about the following terms: farm models, budget, and planning which may be taken in different ways.

PCourbois:sj

Agriculture

Mr. Warren C. Baum

October 29, 1975

M. Yudelman

Audit and Evaluation Reports - Lessons for Future Bank Operations

1. Don Stoops has reviewed the following reports:

a. Final reports which have gone to the Board

1. Project Performance Audit: Bolivia Livestock Projects (Credit 107-BO and 171-BO), October 11, 1974.

2. Closing out of the Evaluation Report of May 1972 on Bank operations in Colombia, September 3, 1975.

3. Project Performance Audit Report: Ecuador First and Second Livestock Development Projects (Loan 501-EC and Credit 173-EC), October 21, 1975.

b. Reports in draft

1. Operations Evaluation Report: Agricultural Credit Programs, September 19, 1975.

2. Project Performance Audit Report, Tanzania Beef Ranching Development Project, October 3, 1975.

2. The above reports have previously been commented on individually. This memorandum synthesizes the most significant lessons which appear to have emerged from the reports, which should be taken into account in future Bank agricultural and livestock credit projects.

3. Inadequate attention has been given to overall sector policy consideration. This has resulted from inadequate information, absence of sector surveys, insufficient Bank leverage to influence changes in government policy, and work pressure under an ever-expanding Bank lending in these fields. For the future, greater attention at the project identification and preparation to sector policy consideration such as price policies, consumer subsidies, interest rates, tax policies, effects on income distribution and labor, market development.

4. There has been an apparent tendency at appraisal to over-estimate projections of increased production which would result from improvement of technical parameters (calving rates, mortality, improvement of pastures, crop yields, etc.). These have been reffected in the models used to project potential project results. While overall production objectives have generally been achieved, as emphasized in paragraph 7.1 of the report on the Five Agricultural Credit Projects (which included Mexico and Uruguay livestock credit projects), the increases have resulted from a somewhat different mix than projected at appraisal.

./...

5. This tendency should be corrected in the future by greater attention at identification, preparation and appraisal. The appraisal reports should emphasize, however, that the models are projections and not blueprints for project design and execution. (The latter was presumed to be the case in most of the reports). Moreover, in credit type projects the appraisal reports should emphasize that the actual mix of factors which will influence project objectives will fluctuate according to economic, financial and political conditions, all of which will influence the sub-borrowers amount and nature of credit demand. The Bank loan should have the flexibility within reasonable limits to accomodate these fluctuations. Increased attention to in-country research, and the use of information available from both national research programs and the international research centers, should help to provide more information on technical parameters. However, appraisal reports should make clear that these parameters are not fixed, are influenced by many natural and man-made factors, and will probably range between x and y.

6. Management is probably the most important factor in a project's success. Where management has been good, as in the case of Bolivia, Ecuador, Mexico and Uruguay, project objectives have generally been achieved. Where it has been poor, as in the case of Tanzania, project objectives have not been achieved. In future projects, the Bank should even increase the traditional attention it has given to management, to the point where the provision of adequate key management becomes a condition of loan signing. Adequate management would involve both local and expatriate personnel.

7. The services of scarce technical personnel have tended to be very demanding for sub-borrower evaluations, thus reducing their availability for technical assistance and field supervision of sub-borrowers. In the future this could be partially corrected by the use of more non-technical (para-technical) personnel on sub-loan processing, thus freeing the technical personnel for more technical tasks.

8. The Agricultural Credit Evaluation also suggests dividing credit projects into "permissive" and "promotional" types. Permissive projects would provide credit, but little or no technical assistance. Promotional projects would focus on specific physical targets associated with the use of new technologies, and technical assistance would be focused on the sub-borrowers under these projects. This has merit where adequate research and extension services are available, or where balance of payments considerations are paramount. However, the case would be rare where a sub-borrower under both types of projects would not need technical assistance to one degree or another.

./...

9. Farm/ranch level monitoring have in most cases been inadequate or totally lacking. Mexico and Uruguay are making some progress in monitoring, but improvement is needed. Future appraisal reports and loan documents should provide more specifics for such monitoring (as was done in the case of Mexico and Uruguay), and sufficient funds should be included in Bank/IDA loans and credits to finance such personnel, including consultants, and other costs necessary to perform the monitoring tasks.

DStoops:mam

logged

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Agriculture & Rural Dev.

In reply please refer to:
Prière de rappeler la référence: EHE

23 October 1975

Dear Mr Christopherson,

I should like to thank you for the meeting I had with you on 8 September 1975 and for the information with which you provided me with respect to the rural development programme of IBRD. This information is of very great value and we are now following up on the discussion with respect to the more effective involvement of WHO field staff in future IBRD missions for rural development. Any proposal which may be worked out will be communicated to IBRD as soon as possible.

Yours sincerely,

for Dr B.H. Dieterich
Director
Division of Environmental Health

Mr L.E. Christopherson
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Dr B.H. Digerfeldt
Director
Division of Environmental Health

Yours sincerely,

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with respect to the rural development programme of IBRD. This information
8 September 1975 and for the information with which you provided me
I should like to thank you for the meeting I had with you on

Dear Mr Christopherson,

23 October 1975

EHE

Please be invited to reference:
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Agricultural + Rural Dev

Mr. S.J. Burki

October 23, 1975

Colin Bruce CB

Proposed Issues Paper on Agricultural Subsidies and Prices

Reference Mr. Chenery's memorandum to Mr. McNamara, dated October 14, 1975 ("Topics for Policy Analysis and Your Governor's Speech"), my memorandum to Mr. Yudelman, dated October 16 and the discussion which Graham Donaldson, Marto Ballesteros and I had with Gil Brown, you and I have spoken and I would like to record my understanding of what has been agreed.

The date of June 1976 given in Annex 1 of Mr. Chenery's memorandum for an Issues Paper on this subject is unrealistic. We do not want to get locked into a timetable with respect to this important topic because we believe--and I think you share this view--that unless an empirical approach is adopted there is a danger of the Issues Paper becoming a theoretical first-year university primer on pricing. If we wish any eventual Policy Paper to have any chance of influencing our member governments, it is important that it illustrate economic principles with the lessons drawn from experience. Hence the importance we attach to carrying out about five case studies, some of which may utilize existing empirical data.

The empirical research cannot be carried out in a vacuum. Hence it is necessary to design and agree on (a) an analytic framework and (b) a work program. In order to keep Mr. McNamara informed, a memorandum will be prepared by about the end of November incorporating the analytic framework and work program. In the meantime, while Marto Ballesteros is completing his work on an agricultural sector survey report and while he is away on sick leave during the first two weeks of November, Gil Brown will make a search of the literature and contact people we have suggested who may be able to help. He and Marto Ballesteros will then get together to draft the memorandum to Mr. McNamara.

I shall see that Marto Ballesteros allocates a reasonable amount of his time to this project but I wish to repeat what I told you over the phone--our work load with respect to reviewing agriculture and rural development appraisal reports during the last half of FY76 is going to be very heavy. There are 102 agriculture and rural development projects in the FY76 pipeline, and, due to bunching, a large proportion of those which will eventually go to the Board in FY76 (about 70) will be processed in the last half of the financial year. Marto will have to take his fair share of our responsibilities in this connection. The other members of our Division are also engaged on research/policy formulation/guidelines work which has just as high priority as that new proposed for agricultural subsidies and pricing.

Finally, we discussed the possibility of using the Bank Lending for Foodgrains Policy Paper as a vehicle for providing Mr. McNamara with an indication of the issues involved in agricultural subsidies and pricing.

While I welcome the inclusion of a chapter on pricing in the Foodgrains paper, it will not cover all the issues involved. Indeed, any conclusions in the Foodgrains paper regarding pricing issues should be cautious and tentative and refer to the work which is to be done on the wider sectoral issues.

cc: Messrs. Yudelman, Donaldson, Ballesteros, G. Brown

CBruce:ssp

Agriculture & rural Dev

Those Listed Below

October 17, 1975

Leif E. Christoffersen

Rural Development Working Paper No. II - Forestry in Rural Development - Draft for Comments

Attached is a draft paper on Forestry in Rural Development by Sydney Draper of the Rural Development Division, CPS.

It is becoming more apparent that wood resources play a vital role in the economics of the rural poor. This is particularly true for fuel for cooking and for building poles for the most rudimentary of housing. The subject also has important implication for soil conservation, developing rural charcoal industries, and for additions to cash income in rural areas.

We would appreciate comments on or before December 1, 1975, and will shortly thereafter schedule a working seminar to discuss the paper as an aid to Rural Development work in the Bank.

TJD/jd

c.c. Rural Development Division Members

Messrs. Yudelman
Darnell
Bruce
Stoops
Pickering
R.D. Rowe
Wolffelt
Courbois
Hendry
Walton
Walden
R.E. Rowe
Wadsworth
Van Gich
Vergin
Sutherland
Golan
P. Greening

Messrs. Powell
Picciotto
Spall
Parsons
Pranich
Haynes
ffrench-Mullen
Frank
Le Moigne
Blaxall
Goffin
Haasjes
Kirpich
Leiserson

Agriculture + Rural Dev.

Mr. Christoffersen, Agriculture & Rural Development

October 14, 1975

Mahmud Burney, IRD

Joint Planning Exercise in Rural Development

The Working Group of the Preparatory Committee reviewed the progress of the Bank consultant's report. Attached is a marked-up copy (not very legible) of the summary of the discussion as well as of the decisions taken. You will see that most of the substantive discussion relates to what would happen after the consultant's report is completed. There were attempts (FAO) to modify the consultant's terms of reference, but we had little difficulty in squelching that. There is a great deal of confusion still whether the exercise could eventually seek a basis for a system-wide effort in "substantive (policy and research)"-type activities, or what is known as "regular programs", or on "field-related operational" activities. We succeeded in keeping focus on this first stage study, which should give all concerned a reasonably good idea as to the UN System's capacity in the rural development field - both substantive and operational. The conceptual problems have still to come - after the Obaidullah Khan report is completed and the task force starts its work in February/March 1976.

As you will see, the consultant's report should be completed by the end of January. It may seem tight, but since we don't have the "inter-agency" meeting in January, this may not be too difficult. I will be back from New York on Wednesday (October 15) and we should get together with Obaidullah - at your convenience on October 16.

Obaidullah's progress report was well received and as you will see his work was complicated. You will soon have a copy of the final report of the discussion.

cc: Mr. Hoffman
Mrs. Boskey
Mr. Grenfell

MB:tsb

STANDING COMMITTEE ON COMMONWEALTH FORESTRY

Agriculture + Rural Dev
cc KI C draft for this.

FORESTRY COMMISSION
231 Corstorphine Road Edinburgh EH12 7AT

Telephone 031-334 0303

Mr Robert S McNamara
President
International Bank for
Reconstruction and Development
1818 H Street
WASHINGTON D C

172

Your reference

Our reference C26/4/7

Date 10 October 1975

Dear Mr McNamara,

STANDING COMMITTEE ON COMMONWEALTH FORESTRY

1. The Commonwealth Forestry Conference, held every 6 years, is a major event in world forestry. The Tenth Commonwealth Forestry Conference, held at Oxford, England in September 1974 was attended by over 200 participants from some 22 countries. I have been asked by the Standing Committee on Commonwealth Forestry to bring to your attention a recommendation approved by the participants at the Tenth Conference.

2. The Conference, in considering afforestation schemes in developing countries which are normally labour intensive and bearing in mind that the employment of surplus man-power is frequently an important object of national economic policies leading to greater economic development opportunities, referred to difficulties which have arisen in the past in financing such schemes because of a lack of willingness on the part of international financial institutions to fund local costs. The Conference therefore RECOMMENDED that "The attention of international financing institutions be drawn to the desirability of assisting in the funding of local costs of approved labour-intensive forestry projects".

3. I would be glad if you would bring the recommendation to the attention of your Board of Governors and to your Executive Directors. It would also seem appropriate to bring the recommendation to the attention of your two affiliate bodies, the International Development Association and the International Finance Corporation, both of which I understand have similar financing objectives in the developing countries, and I would be glad if you would do this.

4. Commonwealth Forest Services are being asked to submit interim progress reports on action taken on the Conference's recommendations by 30 June 1977. If the International Bank would also like to produce a report on any action that it has felt able to take on this particular recommendation we would be very pleased to receive it by mid-1977 so that we can circulate the information to Commonwealth countries along with the reports from Commonwealth Forest Services.

5. At the request of the Standing Committee, I am also writing to Dr Boerma, the Director-General of the Food and Agriculture Organisation of the United Nations, as to the possibility of financing local costs as envisaged under the World Food Programme.

6. I enclose a copy of the Conference's Proceedings, Committee Reports and Recommendations. The recommendation to which I refer is on page 185.

Yours sincerely,
J A Dickson

J A Dickson
Chairman of the Standing Committee

STANDING COMMITTEE ON COMMONWEALTH FORESTRY

FORESTRY COMMISSION
231 Corstorphine Road Edinburgh EH12 7AT

Telephone 031-334 0303

Mr Robert S McNamara
President
International Bank for
Reconstruction and Development
1818 H Street
WASHINGTON D C

Our reference C26/#/17

Your reference

Date 10 October 1975

STANDING COMMITTEE ON COMMONWEALTH FORESTRY

1. The Commonwealth Forestry Conference, held every 6 years, is a major event in world forestry. The Tenth Commonwealth Forestry Conference, held at Oxford, England in September 1974 was attended by over 200 participants from some 22 countries. I have been asked by the Standing Committee on Commonwealth Forestry to bring to your attention a recommendation approved by the participants at the Tenth Conference.

2. The Conference, in considering afforestation schemes in developing countries which are normally labour intensive and bearing in mind that the employment of surplus man-power is frequently an important object of national economic policies leading to greater economic development opportunities, referred to difficulties which have arisen in the past in financing such schemes because of a lack of willingness on the part of international financial institutions to fund local costs. The Conference therefore RECOMMENDED that "The attention of international financing institutions be drawn to the desirability of assisting in the funding of local costs of approved labour-intensive forestry projects".

3. I would be glad if you would bring the recommendation to the attention of your Board of Governors and to your Executive Directors. It would also seem appropriate to bring the recommendation to the attention of your two affiliate bodies, the International Development Association and the International Finance Corporation, both of which I understand have similar financing objectives in the developing countries, and I would be glad if you would do this.

4. Commonwealth Forest Services are being asked to submit interim progress reports on action taken on the Conference's recommendations by 30 June 1977. If the International Bank would also like to produce a report on any action that it has felt able to take on this particular recommendation we would be very pleased to receive it by mid-1977 so that we can circulate the information to Commonwealth countries along with the reports from Commonwealth Forest Services.

5. At the request of the Standing Committee, I am also writing to Dr Boerma, the Director-General of the Food and Agriculture Organisation of the United Nations, as to the possibility of financing [illegible] envisaged under the World Food Programme.

6. I enclose a copy of the Conference's Proceedings, Committee Reports and Recommendations. The recommendation to which I refer is on page 185.

RECEIVED
1975 OCT 28 PM 5:13

Yours sincerely,

J A Dickson
Chairman of the Standing Committee

Agriculture

Mr. Warren C. Baum

October 2, 1975

Montague Yudelman MY

Recommendations for Support of Research on Non-Food Agricultural Products

Background

1. The Secretary of State's speech to the Seventh Special Session of the United Nations Assembly contained the following references to non-food agricultural research:

> " A second critical area for technological innovation is food production and improvement of nutrition.
>
> During the past decade, a number of international agricultural research centers have been established to adapt techniques to local needs and conditions. In 1971 the Consultative Group for International Agricultural Research was formed to coordinate these efforts. The United States is prepared to expand the capacity of these institutes. In collaboration with national research organizations with more skilled manpower and funds, they could grow into a worldwide research network for development of agricultural technology.
>
> We are also supporting legislation in the Congress to enable our universities to expand their technical assistance and research in the agricultural field. Non-food agricultural and forestry products are a third strategic area for technological assistance. The export earnings of many of the poorest countries -- and the livelihood of many millions of their people -- depend on such products as timber, jute, cotton, and natural rubber, some of which have encountered serious problems in the face of synthetics. They urgently need assistance to improve the productivity and competitiveness of these products and to diversify their economies.
>
> The United States, therefore, proposes creation of an organization to coordinate and finance such assistance. Its task will be to attract manpower and capital for research. The financing of this effort should be a priority task for the new International Fund for Agricultural Development." 1/

1/ Quotes found on Pages 10 and 11 of address of The Honorable Henry A. Kissinger Secretary of State before the Seventh Special Session of The United Nations General Assembly.

2. The Special Session of the U.N. adopted a resolution containing the following language:

> "In view of the significant impact of basic and applied agricultural research on increasing the quantity and quality of food production, developed countries should support the expansion of the work of the existing International Agricultural Research Centres. Through their bilateral programmes they should strengthen their links with these International Research Centres and with the National Agricultural Research Centres in developing countries. With respect to the improvement of the productivity and competitiveness with synthetics of non-food agricultural and forestry products, research and technological assistance should be co-ordinated and financed through an appropriate mechanism." 2/

3. The U.S. proposal was apparently the result of the work of the Policy Planning Staff of the State Department, assisted by the research capability of the Office of the Science Advisor to the President. The principal work in this latter office was done by Victor Radcliffe and the proposal was first reviewed by Under Secretary Robinson of the State Department and subsequently submitted to Mr. Parker, Administrator of USAID, who ultimately supported and elaborated on the proposal. Chuck Frank of the Policy Planning Staff of State Department was the principal conduit through which proposals were ultimately made and included in the drafts of the Secretary's speech, the primary reponsibility being with Under Secretary Robinson.

4. The final drafts of the speech were submitted to the interdepartmental Committee on Economic Policy which includes representatives of interalia State, USAID, Treasury, and Commerce. Apparently, there was no direct involvement of USDA in this proposal although they perhaps had an input through the review made by USAID. There is concern in the US Government over the possible negative reaction by US cotton interests, although the USDA apparently did not have the opportunity to indicate this concern directly.

5. The rationale behind the recommendation is concisely laid out in a draft paper prepared by Radcliffe entitled, "Additional Notes Concerning the Proposed U.S. Initiative in the Natural Products Field", a copy of which is attached. The political background of the proposal seems to have a strong link to the LDCs proposal for new systems for stabilizing earnings from their commodity exports by the Dakar, UNCTAD and Commonwealth Ministers Meetings and more significantly the Lome Meeting in February 1975 between the European committees and 46 African, Caribbean and Pacific countries.

2/ - Ad Hoc Committee of the Seventh Special Session, Agenda item 7, Paragraph 7 of "Draft Proposal submitted by the Chairman in the light of informal meetings and consultations. Addendum. V. Food and Agriculture. (I am advised that the final resolution contains identical language.)

6. The U.S. position until recently had been against inclusion of commodity discussions with those on energy and was generally against any market intervention in this field. Now the U.S. has somewhat modified its position in proposing a Commission on Raw Materials for the next phase of the dialogue between oil producers and consumers. Apparently, it is the U.S.'s position to promote world stability through mechanisms to sustain rates of LDC development but to do so with minimum marketing interferences. Apparently, the commodities with which this policy is concerned not only include the fuel and non-fuel minerals but the "natural products" which are significant export items in several countries. (There is still no settled generic term for the commodities which have been variously referred to as natural products, non-food agricultural products, and renewable resources. These generally include plant fibres and oil, tropical woods, natural rubber and animal products such as hides, leather and wool.)

7. As to the need -- the proponents of the proposal argue that a special effort is required on the following grounds:

(a) many countries are heavily dependent on these commodities for a large percentage of their export earnings;

(b) these commodities have suffered from strong competition from synthetics -- often petroleum based;

(c) these commodities are not now receiving the research attention from private sector sources that once was the case; and

(d) there is the potential for substantial gains from research efforts not only in production but also in processing and marketing which can produce substantial incremental benefits; and

(e) from the U.S.'s viewpoint, that considerable political impact could be made with relatively little aid expenditure.

8. As to the mechanism, the question is still wide open; neither the Secretary's speech nor the U.N. resolution makes any suggestions of the mechanism. However, the background information contains continued reference to the CGIAR which has gained a very favorable international recognition as a workable mechanism. In the paper prepared by Radcliffe, it is proposed that an "umbrella organization be set up analagous in financial and research organization to the CGIAR". However, there appears to be a presumption that there will need to be a new organization because: (a) CGIAR has devoted its priorities exclusively to food crops and that effort should not be diluted; (b) research in natural products will emphasize strongly the processing, marketing and utilization of these products, unlike CGIAR which aims only at production; and (c) some of the relevant research activities are new and may be supported in industrialized countries as well as in LDCs.

Bank Position

9. The Agricultural and Rural Development Department believes that the stated premises are wrong regarding the need for added international financial resources for research and the need to create an umbrella organization for exchanging information on agricultural research on non-food crops. It is our view that there is a considerable amount of highly successful research now being undertaken in major non-food crops. This applies particularly to the beverages, cocoa, coffee and tea. We believe that the coffee research in Colombia and Brazil is of outstanding quality. Similarly, we believe the research work being undertaken on tea in East Africa and South Asia is of high quality.

10. The picture on the fibers is somewhat mixed. We believe that the work on cotton, especially in the United States, has helped to spread cotton production throughout the world and to raise productivity in the U.S. and elsewhere. There is also very good work being done in the Sudan and elsewhere. The quality of research on hemp, kenaf, and sisal remains problematic. The work on oil palms is of the highest quality, especially in West Africa and latterly in Malaysia. There is also no question that it is only the very effective work undertaken in Malaysia which has enabled natural rubber to remain competitive over the last two decades.

11. Generally, work on non-food export crops has been well funded; funding has often been through an export levy or some form of cess. In addition, in many instances, exporters themselves have combined to finance research. In our view, finance per se is not necessarily a limiting factor on research; the self-financing element in non-food crops helps explain why there is such a good basis for research in these commodities. In this respect there is a vast difference between the position vis-a-vis food crops and non-food crops and helps explain why the CGIAR was essential to fill a vacuum that does not exist for commercial crops.

12. In the light of the above, we believe that the position already taken by TAC, namely that priority must be given to supporting research into food crops through the CGIAR, is the correct one.

13. We do not see any need for financing a large-scale effort in non-food crops - we do not believe that money is the limiting factor for research on these crops. It may well be that there is need for an improved system for exchanging information on non-food crops, even though most commodity groups have their own umbrella organization and most of them have active programs for exchanging notes and disseminating information.

14. Our tentative recommendation is that we continue with our current policy placing our major emphasis in our association with CGIAR. We believe that we should increase our support for food crops before we divert resources for non-food crops; the food problem will be with us for many years and we need greater efforts in this area. While we do not believe that the Bank should become involved in international research efforts regarding non-food crops, we do believe that, where appropriate, we finance research on these crops in our general programs of support for national systems. Finally, we believe that if there is to be an organized exchange of information on research in non-food crops then this can best be done by FAO through the Agris or some similar information system.

15. We suggest that we check our views with TAC, FAO, the Foundations and others before submitting a final recommendation.

cc: Messrs. Lejeune
Weiss
Darnell
Fransen

MYudelman:sj

Agriculture

Ambassador E. Martin

September 29, 1975

R. Picciotto

Incentives to Farmers

The statement on p. 37 of the Bank's Annual Report ("The shortcomings in agriculture development in South Asia are generally not a matter of ... lack of farmer motivation") should not be read as a blanket endorsement of pricing policies pursued by Governments in South Asia. We certainly did not mean to underrate the importance of price, tax and similar policies of interest to the CGFPI. We were simply trying to say that Asian farmers, including small farmers, are less tradition bound and more enterprising than they are generally given credit for. And we were emphasizing water control, inputs and supporting services (including marketing systems) as key constraints to agriculture development.

The importance of adequate price incentives is a recurrent theme of Bank Group agriculture sector studies. Within South Asia the issue is particularly crucial in Burma and Nepal which enjoy a grain surplus. In all countries of the Region the issue has been complicated by the political short-run imperative to procure sufficient grain at reasonable prices to feed public distribution systems in the cities--a difficult task given the worldwide food shortage.

RPicciotto/cta

cc. (w/incoming): Messrs. Weiner
van der Meer
Yudelman
Gilmartin
Kavalsky
Parsons
Pranich
Spall

/ Agriculture & Rural Dev.
- CI - 4N

Mr. Montague Yudelman

September 26, 1975

Ted J. Davis and Jim Goering

Kissinger's Speech and Special U.N. Session on Recommendations for Support of Research on Non-food Agricultural Products - Background Information

1. The Secretary of State's speech to the Seventh Special Session of the United Nations Assembly contained the following references to non-food agricultural research:

> "A second critical area for technological innovation is food production and improvement of nutrition.
>
> -- During the past decade, a number of international agricultural research centers have been established to adapt techniques to local needs and conditions. In 1971 the Consultative Group for International Agricultural Research was formed to coordinate these efforts. The United States is prepared to expand the capacity of these institutes. In collaboration with national research organizations with more skilled manpower and funds, they could grow into a worldwide research network for development of agricultural technology.
>
> -- We are also supporting legislation in the Congress to enable our universities to expand their technical assistance and research in the agricultural field. Non-food agricultural and forestry products are a third strategic area for technological assistance. The export earnings of many of the poorest countries -- and the livelihood of many millions of their people -- depend on such products as timber, jute, cotton, and natural rubber, some of which have encountered serious problems in the face of synthetics. They urgently need assistance to improve the productivity and competitiveness of these products and to diversify their economies.
>
> -- The United States therefore proposes creation of an organization to coordinate and finance such assistance. Its task will be to attract manpower and capital for research. The financing of this effort should be a priority task for the new International Fund for Agricultural Development." 1/

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2/ - Ad Hoc Committee of the Seventh Special Session, Agenda item 7, Paragraph 7 of "Draft Proposal submitted by the Chairman in the light of informal meetings and consultations. Addendum. V. Food and Agriculture. (I am advised that the final resolution contains identical language.)

6. The U.S. position until recently had been against inclusion of commodity discussions with those on energy and was generally against any market intervention in this field. Now the U.S. has somewhat modified its position in proposing a Commission on Raw Materials for the next phase of the dialogue between oil producers and consumers. Apparently, it is the U.S.' position to promote world stability through mechanisms to sustain rates of LDC development but to do so with minimum marketing interferences. Apparently, the commodities with which this policy is concerned not only include the fuel and non-fuel minerals but the "natural products" which are significant export items in several countries. (There is still no settled generic term for the commodities which have been variously referred to as natural products, non-food agricultural products, and renewable resources. These generally include plant fibres and oil, tropical woods, natural rubber and animal products such as hides, leather and wool.)

7. The basic issues are: (1) are the research and development needs such that a special internationally supported effort is required to improve the production, processing, marketing and utilization of these non-food commodities? and (2) if so, what kind of mechanism would be most appropriate?

As to the need -- the proponents of the proposal argue that a a special effort is required on the following grounds:

(a) many countries are heavily dependent on these commodities for a large percentage of their export earnings;

(b) these commodities have suffered from strong competition from synthetics -- often petroleum based;

(c) these commodities are not now receiving the research attention from private sector sources that once was the case; and

(d) there is the potential for substantial gains from research efforts not only in production but also in processing and marketing which can produce substantial incremental benefits; and

(e) from the U.S.* viewpoint, that considerable political impact could be made with relatively little aid expenditure.

8. As to the mechanism, the question is still wide open. Neither the Secretary's speech nor the U.N. resolution makes any suggestions of the mechanism. However, there is in the background information and in my discussions with involved individuals, the continued reference to the CGIAR which has gained a very favorable international recognition as a workable mechanism. In the paper prepared by Radcliffe, it is proposed that an "umbrella organization be set up analagous in financial and research organization to the CGIAR". The reasons for a new organization are not clear.

However, from the paper and from discussions with Radcliffe, the following facts are claimed to have a bearing which mitigates against including such research under CGIAR: (a) that CGIAR has devoted its priorities exclusively to food crops and that effort should not be diluted; (b) that research in natural products will emphasize strongly the processing, marketing and utilization of these products, unlike CGIAR which aims only at production; and (c) that some of the relevant research activities are now and may be supported in industrialized countries as well as in LDCs.

9. The drafters of the proposals had access to two studies which apparently had considerable impact on the final recommendations. These are: (1) "Report and Recommendation for an Expanded Research Development Programme for Cotton", Rockefeller Foundation, August 15, 1975, and the "Report of the Tropical Products Institute Research Needs and Priorities in Relation to Certain Agricultural Commodities". Both of these reports are persuasive and perhaps were significant in the suggestion made in the Radcliffe paper that the first commodities to be addressed would possibly be cotton and jute. Cotton for the reason that it is universally important in developing countries and jute for the reason that in Bangladesh and India poverty populations are heavily dependent on the commodity for cash income. A suggested third commodity priority is timber and timber products, particularly the pulp woods. Apparently, the Canadians are exploring possible interest in an International Forest Products Research Center.

Cleared with and cc: Mr. Goering

cc: Mr. Darnell
Mr. Fransen

Attachment

TJD/cr

Agriculture

INTERNATIONAL DEVELOPMENT ASSOCIATION | INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT | INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: Mr. Robert Picciotto

DATE: September 25, 1975

FROM: Edwin M. Martin

SUBJECT: Incentives to Farmers in South Asia

The CGFPI is expected to discuss the impact of developing country price, tax and similar policies on the desire and capacity of farmers to use increased investment to increase yields. Should we assume from the statement on p37 of the Bank's annual report that in South Asia there is no "lack of farmer motivation" that the policies of those governments have given farmers all necessary incentives?

Agriculture & Rural Dev.

Mr. Warren C. Baum

September 18, 1975

Montague Yudelman MY

Poverty Alleviation: Operational Objectives and Monitoring - Comments on the Ahluwalia/Duloy Memorandum of August 19

1. I attach a considered and thoughtful response to the above memorandum prepared in the Rural Development Division.

2. I would like to add two comments which relate to the statement in the memorandum that our actions are not consistent with our public stance on rural poverty and equity:

(i) The authors of this memorandum do not seem to appreciate that the stated Bank policy for the rural areas includes raising productivity of those outside the target groups; this helps explain why we have suggested that half the lending in agriculture be for rural development as we have defined it. [Furthermore, we took into account absorptive capacity; we feel that a program of $3.5 billion for rural development was about all we could handle in 5 years.]

(ii) I know of no project that can claim to provide exclusively and solely for the absolute poor. Our experience in area projects, irrigation projects, and credit projects indicates that the beneficiaries have a fairly wide spectrum of incomes; frequently the bulk of the beneficiaries may be in the bottom 40%, but very often many of the beneficiaries will lie between the bottom 40% and 60% of the income range. I consider raising the productivity of the poor to be important; I'm not sure that too much is to be gained by arguing about whether they are poor or very poor. Thus, the point about a precise limit for cutting off target increases and its effects on income distribution is not very helpful.

3. In the light of the above, I would hesitate to encourage refinement that adds nothing to our operational procedures. The data base in rural areas is so problematic that I believe little would be gained if, as a result of major research efforts, we concluded the target income group in rural areas had incomes of ($\pm$) 10% our current crude estimates.

Attach.

MYudelman:sj

cc: Messrs. Chenery
Stern
van der Tak
Jaycox
Leiserson
DPS Directors (Ul Haq, Tims, Gulhati, Duloy, Muller)

INTERNATIONAL DEVELOPMENT ASSOCIATION | INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT | INTERNATIONAL FINANCE CORPORATION

PR

OFFICE MEMORANDUM

TO: (See distribution list below)

DATE: September 12, 1975

FROM: Ted J. Davis - Rural Development Division - CPS
Agriculture & Rural Dev. Dept.

SUBJECT: Crop and Livestock Insurance - Rural Development Working Paper II

1. In the attached Rural Development Divison working paper sent for your perusal, Vincent R. McDonald, a consultant, discusses crop and livestock insurance as a possible instrument of small farmer support. A previous draft was circulated last spring which has now been updated after field work in Kenya and Mauritius. The paper finds that insurance, in addition to providing protection against painful calamities, can contribute substantially to improving both small farmer confidence and creditworthiness. There are however many limitations and constraints to adopting insurance programs in LDCs, but these could be overcome with government support and external financial and technical assistance.

2. It is proposed to explore this subject further, particularly sound the views of Bank staff on the feasibility of extending Bank support to such programs, at a seminar scheduled for October 21, 1975 at 2:30 pm in Conference Room D-860. Meanwhile, any written comments on the working paper will be appreciated.

TKulatilaka:pm

cc: Rural Development Division Members

Messrs. Yudelman
Darnell
Bruce
Stoops
Wolffelt
Courbois
Donaldson
Hendry
Walton
Walden
Rowe
Wadsworth
Van Gigch
Vergin
Sutherland
Golan
Powell
Picciotto
Spall
Parsons
Pranich
Haynes
ffrench-Mullen
Frank
Le Moigne

Messrs. Blaxall
Goffin
Haasjes
Greening
Kirpich
Leiserson

OFFICE MEMORANDUM

Agriculture + Rural Dev

TO: Mr. T. J. Goering

DATE: September 12, 1975

FROM: J. C. Collins

SUBJECT: Land Settlement Issues Paper (First Draft)

1. I would first of all like to congratulate the authors on what I consider to be an excellent paper. It provides a concise review of past experiences in land settlement, develops logical conclusions and, unlike some attempts to define Bank Policy, comes up with clear unambiguous recommendations.

2. In regard to the recommendations, I am in full agreement. Particularly I support requirements that land settlement projects should:

(a) be economically viable;

(b) have a low cost per family in order to achieve the maximum income distribution affect with budgetary constraints;

(c) have a simple agricultural production pattern at least in the early years;

(d) have minimal social infrastructures until the settlers can undertake self-help type improvements;

(e) limit housing assistance to credit for materials (preferably in Kind);

(f) include where shown to be necessary, a degree of subsidy as a means of assisting low income settler families; and

(g) have an effective management organization.

These are all criteria which I and my study team had in mind when preparing the Alto Turi Project in 1970-71 before I joined the Bank. I think the reason that project has not been very successful is partly the result of SUDENE's bureaucratic management but more basically, Government's lack of complete commitment to the low cost approach of Alto Turi as opposed to the much more costly Altamiera Settlement operation. These factors gave rise to initial delays which resulted in the spontaneous settlers moving in before the project was ready to receive them. I would suggest that your paper recommend:

(a) a requirement for clear Government commitment to the low cost approach, where this is advocated, as a condition of Bank participation; and

(b) in circumstances when rapid spontaneous settlement is taking place, the need for very rapid implementation of area surveys and division into lots in

order to avoid a later problem of haphazard holding distribution and the possible need to resettle families should the density of families in a given area be too great to ensure continuous viable holdings.

3. Apart from the above suggestions, I have the following comments on various points in the text:

(a) Page 15, para 6: The impression is that the increase in "cropped area" was largely due to settlement and extension of cultivated areas. I suggest an appreciable increase in cropped area arose through reduction of fallows in crop rotations (the fallow would probably not be included in Government "cropped land" statistics).

(b) Page 30, para 4: I think the decision on which of the two goals is more important can only be decided in the context of individual country and project conditions. I think intensive development of new lands when economically justified is acceptable but the project becomes an "agricultural" type project with settlement merely one of the requirements for success. The second socially oriented approach is a true "settlement" project in which agricultural production is merely a tool to sustain the settlement as a stable community.

(c) Page 49, para 48 (and elsewhere): A considerable point is made of the likely continued rural-urban migration problem. I agree on the desirability of some off-farm employment opportunities but as in Rural Development generally; there seems to be rather a limited scope for rural industry outside the immediately agriculture related supply and processing fields. I am therefore doubtful if efforts in this direction will be very fruitful. I do feel however, that energy shortage effects could by the Year 2000 have resulted in such a deterioration in the way of life in the cities that there will be an appreciable recognition of the benefits of rural living.

(d) Page 52, para 3: While nuclear settlements facilitate provision of water supplies, power and other infrastructure, there is often a preference for on-farm housing. Furthermore, particularly where livestock are concerned it is preferable for the farmer to live close to his animals to ensure their well being. Living on the farm also provides some safeguard against animal damage to and theft of crops. I am not convinced we should make such a strong case for nucleus settlement which unless carefully regulated could become rural slums.

(e) Page 54, para 56 and footnote 2: I do not consider trickle irrigation to be the answer. High energy costs in future may make it prohibitively expensive, it requires constant maintenance and supervision and its use under arid conditions entails a considerable risk of salinity buildup unless the user has considerable irrigation and soil management skill.

(f) Page 67 end of para 11 and elsewhere: In discussion of disease control and environmental factors, I would like to draw attention to the very considerable risk of increasing water associated diseases such as Schistosomiasis when irrigation facilities are expanded for use by low income, often illiterate settlers. This risk should be taken into account and the high costs of maintaining control would probably make traditional irrigation unattractive when compared with rainfed development.

4. I would also draw your attention to the following errors:

Page 50, para 50, line 11 - "two two-thirds" should be "two-thirds

Page 60, para 8, line 4 - "rize" should be "rice"

Page 67, para 12 - Period 1970 to 1975 referred to in first sentence is not a 15 year period as stated in second sentence

- Line 6: "4-5 ha annually" should be 4-5 m ha annually"

cc: Messrs. Haynes, Le Moigne, ffrench-Mullen

JCCollins:ls

Agriculture + Rural Dev

Messrs. A. Egbert and H. Kim, AGPRD

September 9, 1975

Michael J. McGarry, Acting Chief, LCPA2A

A computer system for agriculture and rural development project appraisal

1. I have now reviewed the document entitled "A Proposed System for Data Processing and Analysis of Agriculture and Rural Development Projects" and on the whole I believe that it gives the outlines of what the Bank needs at this time to mechanize its appraisal work. Listed below are some general comments.

2. In the introduction I think the attempt to make it appear that the proposed system would do anything more than add speed and accuracy is misleading. On appraisal missions that I was on I could equally state: ... The core of the project analysis is the farm, its performance, and its development. Emphasis is given to farm's financial and economic viabilities. The impact of the project on farms is directly reflected in project benefit and cost streams. We assume that the sum of all farms constitute the project area; and that the sum of the net farm benefit forms the major part of project benefits. The delay of the project would postpone farm development and consequently lower the project benefits... We always took phasing into account both on the individual farm and in the project area as a whole. Otherwise how could we have arrived at project aggregates that reflected the time value of money? Maybe there are instances where this was not done but your introduction makes it appear that your system is going to do something new in this respect which I do not think is true.

3. In Chapter II I have no problem with the general approach which reflects present practice in project appraisal. I am curious though as to why "Net Present Values" are to be added? If one were deciding between many possible projects, then "net present values" would help to rank projects but surely this is appropriate only in the identification/preparation stage and adds virtually nothing to the analysis at the stage where the Bank is appraising and merely assuring itself that this project is economically justified. This assurance can be obtained quite adequately from rate of return analysis. My concern is that everytime we add something new it means more time devoted to appraisal, when already we are spending too much. I am worried about all the memos that will be generated by the issue of the opportunity cost of capital. At least rates of return analysis keeps this ticklish issue in the background.

4. I feel it is crucial to the usefulness of the whole approach that the crop and livestock budget preparation be mechanized. If this is not done then we will be deprived of one of the real advantages of the whole approach, namely the ability to do sensitivity analysis on technical coefficients in a speedy manner. This is an area that is in need of much attention at present. My worry comes from the apparent decision not to build a livestock budget program at this time.

5. The assumption on page 18 that prices will be the same between farms is unrealistic especially for sector wide credit projects in countries such as Mexico and Colombia.

6. I have many problems and questions regarding the cash-flow analysis. While the basic concept that cash flows should be in current terms is of course correct, it may not always be meaningful to do so as for example if inflation is in the 100% p.a. bracket and fluctuating (Chile, Uruguay, Argentina, etc.). How should such cases be handled? On a more controversial point, should cash flows at the farm budget level be done for the farm (firm, corporation) or for the farm family? This subject is worth a little thought I think. Personally, I think on balance I would prefer to see it done for the farm. This way the whole subject of estimating non farm income and debt for an average farmer is avoided, and anyway it is not a fruitful exercise. Another basic function that cash flows must serve is to help determine the appropriate terms for the loan i.e. length of grace period, etc. Is there anything in the intented program to solve this?

7. Is it always appropriate, as is indicated, for crop costs and benefits to appear in the crop year to which they apply? Maybe the log between costs and benefits within the year could be better reflected for purposes of rate of return analysis by having no benefits appearing in say year one? I just want to raise this matter with you and hopefully we can explore it more fully at another time.

cc: Messrs. Blaxall, Goffin, Haasjes, Greening and Kirpich.

MJMcGarry/nr

AGRICULTURE

Mr. Leif Christoffersen,
Chief, Rural Development Division.
Vincent R. McDonald, Consultant.

September 4, 1975

Report on "Crop and Livestock Insurance : An Aid to Small Farm Development"

1. I wish to state my appreciation for the opportunity to carry out this study. Over the period of its preparation, I have come to feel quite strongly that, in spite of many difficulties, agricultural insurance is a viable alternative to ad hoc government support in the face of catastrophic situations as well as a technique in effecting production changes.

2. As this report is read, and as the Bank considers the merits of incorporating insurance into its agricultural lending activities, it is important that continued investigation should be carried out to look at other experiences in dealing with crops other than those dealt with in this report. It might be useful to document the incidences of livestock, farm machinery and fishing boats and equipment insurance - all areas of concern - in promoting innovative agricultural programs. The effort of follow-up to this report should be on a permanent basis. A staff member should monitor activities in this area on a year-round basis. It might also be appropriate for a permanent questionnaire - general enough to be used in any country - which could be used by survey or identification missions to be developed and used as a means of determining the level of existing programs or the level of interest in instituting such programs.

3. The Bank's role in support of such programs could proceed in the following areas. From a short-run point of view, it can assist developing countries with insurance programs by providing technical assistance in the form of insurance specialists to advise and train local staff in better carrying out their responsibilities. Or, it can provide opportunities for local staff personnel to travel to some of the developed countries e.g., Japan, Canada, United States with successful programs to study alternative approaches to their programs. In its more long-term approach however, the Bank's approach should be as follows:

(a) Using its economic or identification missions to determine the feasibility of such a program in agricultural lending,

(b) Providing insurance specialists on loan to such a country and/or educational opportunities for local officials once there is mutual agreement to incorporate insurance into planned projects; and,

(c) Providing credit, ranging up to 20 percent of the credit component for agricultural production where it has been established that the basic infrastructure is present.

4. My own interest in this area continues. I will be happy to avail myself for future assignments in this area, or any other, for periods which is mutually agreeable. It is my belief that a Seminar discussion on the whole question of agricultural insurance incorporating the Department of Agriculture and Rural Development and interested persons for the related project divisions would be an appropriate setting for clarifying any questions or misunderstanding in this paper. I will be prepared to be available at a mutually agreeable time to discuss the contents of this paper.

VRMcDonald:jd

c.c. Messrs. M. Yudelman
T.J. Davis
T.M. Kulatilaka
A.T. Schumacher

Agriculture

INTERNATIONAL DEVELOPMENT ASSOCIATION | INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT | INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: Agricultural Projects Staff DATE: September 3, 1975

FROM: M. Yudelman

SUBJECT: SEMINAR - New Directions in Crop Production Research: Carbon and Nitrogen Inputs

Dr. Ralph Hardy, Associate Research Director for the Du Pont corporation (E.I. du Pont De Nemours & Company) will lead a discussion in the Bank on "New Directions in Crop Production Research: Carbon and Nitrogen Inputs". All interested staff members are invited to attend.

Place: D.556

Time: 3.30 p.m. Wednesday, September 17, 1975.

Please indicate your intention to attend to Moreen Tolerton Ext. 3695.

Mr Elkana.

Please attend for the division. I usually ask staff who attend these Seminars to give a brief account of them at the next div. meeting

5 Sept

cc: R. Picciotto, D. Haynes, J. Hendry, H. Vergin, J. Blaxall, R. Rowe, P. Gittinger, C. Weiss

GFDonaldson:mt

Read by Sept. 17

Improving the Efficiency of Photosynthesis

The opportunity exists to increase crop productivity by regulating wasteful respiratory processes.

Israel Zelitch

"It is the business of agriculture to collect and store solar energy as food energy in plant and animal products." This definition of agriculture comes from a recent report on agricultural production efficiency (*1*), and it seems most appropriate when one considers that 90 to 95 percent of the dry weight of plants is derived from photosynthetically fixed CO_2. Photosynthesis converts electromagnetic energy present in the visible portion of sunlight into the chemical energy needed by green leaves to reduce CO_2 and synthesize our food materials. The practice of agriculture also requires expenditures of cultural energy in the form of labor, fuel, tractors, fertilizers, and pesticides. The amount of cultural energy expended by modern agriculture to obtain food calories varies greatly from crop to crop (*2*). Some forms of cultural energy are already or may soon become in short supply, but sunlight and CO_2, the most important ingredients in the energy conversion in agriculture, are freely available in vast and statistically predictable quantities. They are delivered to field plants without transportation costs of any kind, and we need have no fear of running short of either of them.

Basic research in photosynthesis, especially during the last decade, has revealed a number of possible approaches toward increasing the efficiency of CO_2 assimilation by crops. Efficiency is defined here as the rate of net CO_2 uptake per unit of leaf area or per unit of ground area uncorrected for respiratory losses. Large increases in yields should be obtainable by exploiting this knowledge; it should be possible to diminish wasteful respiratory losses without our having to increase the inputs of cultural energy (*3*). These desirable characteristics can probably be incorporated into plants most easily by utilizing the recent techniques of somatic cell genetics in which tissue cultures are used (*4*), as discussed later herein and by Carlson and Polacco (*4a*).

The author is head of the Department of Biochemistry at the Connecticut Agricultural Experiment Station, Post Office Box 1106, New Haven 06504.

Effect of Photochemical Efficiency and Irradiance on Photosynthesis

Photosynthesis takes place in the chloroplasts, and the overall process can be described by the equation:

$$CO_2 + 2H_2O + \text{light} \rightarrow (CH_2O) + H_2O + O_2 + 112 \text{ kcal/g-atom (of C)}$$

The photochemical energy is used in the first stage to remove electrons from water and produce O_2 and a weak reductant. A second photoact is involved in the further transport of electrons to nicotinamide adenine dinucleotide phosphate (NADP); the reducing power, ultimately in the form of NADPH, together with adenosine triphosphate (ATP) produced by photophosphorylation during electron transport, is used to reduce CO_2 to the level of carbohydrate (CH_2O).

Experiments on the effect of irradiance on CO_2 assimilation in leaves of many species show that at low intensities (less than 3 percent of full sunlight) photosynthesis is linear with irradiance (*3*); thus the photochemistry limits the photosynthetic rate at low irradiance. The efficiency of light energy conversion, expressed as the amount of CO_2 absorbed per quantum of energy absorbed, or as calories of carbohydrate produced per calorie of incident visible irradiation, is about 12 percent at these low irradiances. Net CO_2 assimilation is very slow here, and it increases greatly as the light intensity is increased until saturation is reached at 25 percent of full sunlight (except in the most efficient photosynthetic species, such as maize, where saturation is not attained). The efficiency of light energy conversion, however, decreases with increasing irradiance. Thus the maximal daily efficiency of light energy conversion in a field of maize approached only 3 percent, if one neglects respiratory losses (*5*). Photochemical efficiency is therefore not directly related to net CO_2 assimilation rates; on the contrary, the rate of CO_2 assimilation increases greatly with increasing irradiation and diminishing photochemical efficiency. Since there is already a wide difference in the efficiency of CO_2 uptake between species with presumably similar photochemical efficiencies, as discussed below, I conclude that there is ample opportunity for achieving large increases in CO_2 fixation without affecting the photochemical efficiency.

Rates of photosynthetic electron transport may control photosynthesis under some conditions. In experiments with isolated chloroplasts a faster CO_2 fixation was obtained by increasing photosynthetic electron transport with inhibitors of photophosphorylation (*6*), but it is still uncertain whether electron transport is limiting in leaves. Further evidence that neither the enzymatic rates of carboxylation nor the photochemistry limit photosynthesis at high light intensities in leaves is derived from an evaluation of the magnitude of the various diffusive resistances during transport of CO_2 from the atmosphere to the chloroplast (*3*).

Nevertheless, the total irradiation available for photosynthesis and the duration of photosynthesis are undoubtedly important factors determining final plant productivity. Hence productivity can be increased by planting varieties that have rapid rates of leaf area expansion, by the use of closer plant spacings to capture more sunlight, and by breeding for plants whose leaves have more erect angles of elevation to absorb sunlight more effectively.

The Harvest Index

The harvest index is the percentage of the aerial dry weight of a plant that provides useful food material such as grain or seed. The index is therefore a measure of how the products of photosynthesis are partitioned. Its value can vary from as little as 23 percent to as much as 67 percent (Table 1). Primitive agriculturalists probably inadvertently selected for a greater harvest index when they selected larger seed for planting, and in this century in the United States the change from open-pollinated to hybrid varieties of maize also resulted in an increase in the harvest index from 24 to 43 percent (*7*). Even in recent times the harvest index of different crop varieties is found to differ greatly (Table 1). In wheat it ranged from 23 to 46 percent, while the most efficient partitioning of photosynthate into food is in varieties of dry bean, where the range is 53 to 67 percent. Improving the harvest index will continue to be a worthwhile goal of plant breeders and physiologists, especially as the net photosynthetic CO_2 assimilation is improved.

The Relation between Net Photosynthesis and Productivity

Leaves of efficient crop species such as maize, sugarcane, and sorghum have rapid rates of net CO_2 assimilation at high irradiance in normal air at 25° to 35°C (42 to 85 milligrams of CO_2 per square decimeter of leaf area per hour) (*2*). These species also produce malate and aspartate (4-carbon compounds) as the first detectable product when $^{14}CO_2$ is supplied (*8*), hence they have become known as the C_4 species. Leaves of most other crop species, with few exceptions, assimilate CO_2 at rates about one half or less of the C_4 species. The first product from $^{14}CO_2$ found in the less efficient species is 3-phosphoglyceric acid which is synthesized by the operation of the Calvin cycle pathway (*9*). These species are often called C_3 species.

The maximal rate of photosynthesis (CO_2 uptake at saturating CO_2 concentration and high irradiance) is only slightly faster in maize than in tobacco leaves (*3*), indicating that a greatly different photosynthetic capacity is not responsible for the large differences in net photosynthesis in normal air usually observed between C_3 and C_4 plants.

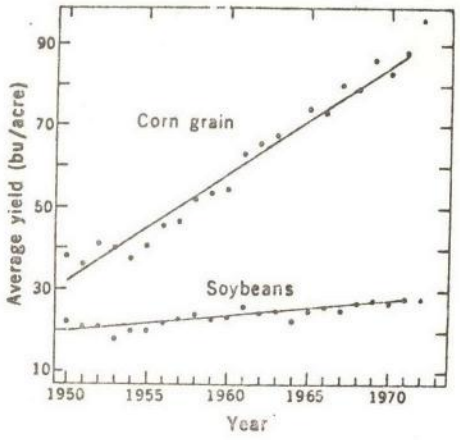

Fig. 1. Average yields per acre of maize grain and soybeans in the United States since 1950 [from (*1*)]. A standard bushel of maize grain weighs 56 pounds, and a standard bushel of soybeans weighs 60 pounds. (One pound of maize grain per acre is almost equivalent to 1 kilogram of grain per hectare.)

Some aspects of the comparative biochemistry of the C_3 and C_4 species as they relate to net CO_2 uptake, glycolic acid synthesis, and especially photorespiration are discussed later in this article.

Since CO_2 fixation provides so much of the dry weight of plants, it is not surprising that rates of net CO_2 fixation by leaves are well correlated with plant productivity. Estimates of the *average* crop growth rate (dry weight produced per square meter of land per week) in the United States for maize silage, sorghum silage, and sugarcane show that these species have two to three times the crop growth rate of photosynthetically less efficient species such as spinach, tobacco, and hay (*3*). Similarly, the literature shows *maximal* growth rates (grams of dry weight produced per square meter of land per day) are about 50 for maize, sugarcane, sorghum, and millet; various other crops with slower rates of net photosynthesis such as rice, sugar beet, and alfalfa have values from 17 to 36 (*3*).

Table 1. The harvest index of some crop species. The harvest index is the percentage of total aerial dry weight at maturity that represents economic yield (grain or seed).

Crop	Harvest index (%)		
	Avg.	Range, different varieties	Reference
Efficient photosynthetic species (C_4)			
Maize, open pollinated, 1920–1926	24		(*7*)
Maize, hybrids, 1958–1959	43		(*7*)
Maize, hybrids	42	38 to 47	(*53*)
Sorghum	41	40 to 41	(*54*)
Other grain species (C_3)			
Rice	51	43 to 57	(*55*)
Barley	48	35 to 52	(*56*)
Oat	41		(*56*)
Wheat	31	23 to 37	(*57*)
Wheat	39	28 to 46	(*56*)
Rye	27	27 to 29	(*56*)
Leguminous species (C_3)			
Dry bean	59	53 to 67	(*58*)
Soybean	32	29 to 36	(*59*)

The average yields of maize grain and soybeans (a C_4 and a C_3 species, respectively) over a period of more than 20 years in the United States are compared in Fig. 1. These are two economically important crops, yet net photosynthesis in maize is at least twice as fast as in soybean leaves at high irradiance. Average maize yields have more than tripled in 20 years since 1950 while soybean yields have increased only about 20 percent. The maize grain yields are now three times greater than soybeans because maize varieties that could utilize nitrogen fertilization were bred; presumably such varieties would maintain high photosynthetic rates during the grain-filling period. Soybeans, on the other hand, do not respond positively to nitrogen fertilization (they fix nitrogen from the air). Even the best technology applied to soybean cultivation does not result in greater yields because the low rate of net photosynthesis in these plants has undoubtedly provided a biological barrier. This barrier in soybean and many other crops is largely explained by the process of photorespiration.

The Characteristics of Photorespiration

Considerable experimental evidence indicates that a large part of the differences in net photosynthesis between the efficient and less efficient species results from the release of photorespiratory CO_2 which occurs rapidly (three to five times faster than "dark" respiration) only in the less efficient species. The losses of carbon by photorespiration are derived from recently fixed photosynthetic compounds, and the process therefore seems wasteful. Hence, the slowing of photorespiration by biochemical or genetic means would be expected to bring about large increases in net photosynthesis and yield.

"Photorespiration" refers to the respiration (usually the CO_2 evolution) in photosynthetic tissues that is specifically

associated with substrates produced during photosynthesis. Photorespiration was first used in its current meaning by Decker and Tió in 1959 (*10*) to account for their observation that leaves of many species exhibited a post-illumination outburst of CO_2, which they correctly attributed to the overshoot of a faster form of respiration that occurred only in the light. At about that time, biochemical evidence was also accumulating that glycolic acid, an early product of photosynthesis (*11*), was rapidly oxidized by a leaf enzyme, glycolate oxidase, and that the rate of glycolic acid synthesis could sustain a rapid respiration in illuminated leaves (*12*). It is now well established that glycolic acid is the primary substrate of photorespiration, and that the characteristics of photorespiration coincide rather precisely with those for the synthesis of glycolic acid and its further oxidation to CO_2.

Photorespiration and glycolic acid metabolism have a number of characteristics in common: (i) an enhanced rate of photorespiration and increased synthesis and oxidation of glycolic acid with increasing O_2 concentrations in the atmosphere; (ii) a similar dependence on light intensity and a requirement for actively photosynthesizing tissues; (iii) a relative independence on CO_2 concentration between zero and 300 parts per million (ppm) and inhibition when the CO_2 concentration is increased above about 2000 ppm; and (iv) a strong temperature dependence. More direct evidence of the involvement of glycolic acid comes from measurement of $^{14}CO_2$ output from ^{14}C-labeled glycolate, and the use of inhibitors of glycolate synthesis and oxidation, and from kinetic experiments with $^{14}CO_2$.

The Measurement and Magnitude of Photorespiration

All assays of photorespiration underestimate its magnitude because the measurements have to be made in the ambient atmosphere surrounding the illuminated leaf, and the main flux of CO_2 during assays is into the leaf. The main methods of detecting and assaying photorespiration, and their limitations, have been discussed elsewhere (*3*, *13*). Such assays include the following measurements: the uptake of $^{18}O_2$; the extent of the inhibition of net CO_2 uptake upon raising the O_2 concentration in the atmosphere; the postillumination CO_2 outburst; extrapolation of the curve of CO_2 concentration against net photosynthesis to "zero" CO_2; dilution of the $^{14}CO_2$ specific radioactivity in the ambient atmosphere in a closed system; discrimination against $^{13}CO_2$ as opposed to $^{12}CO_2$ during photosynthesis; the rate of CO_2 released in CO_2-free air (with or without ^{14}C-labeled tissues); the CO_2 compensation point; and the short time of uptake (approximately 15 seconds) of $^{14}CO_2$ minus $^{12}CO_2$ when both are supplied together.

Various assays show that photorespiration in the less efficient photosynthetic species occurs at rates at least 50 percent of net CO_2 uptake (Table 2), while it is barely detectable in the efficient species such as maize. Blocking photorespiration with biochemical inhibitors of glycolic acid synthesis (*14*) or oxidation (*15*) also increases net photosynthesis by 50 percent or more in species with rapid photorespiration but not in maize. Thus the magnitude of photorespiration in C_3 species must be greater than 10 mg of CO_2 per square decimeter per hour; 76 micromoles of CO_2 per milligram of chlorophyll per hour; or 114 mg of CO_2 per gram of fresh weight per hour.

Any proposed biochemical mechanism of photorespiration in a C_3 species must at least be able to account for such high rates of CO_2 production by photorespiration. Several investigators (*16*, *17*) have expressed the view that the CO_2 is released in photorespiration by a biochemical mechanism in which the synthesis of glycolic acid occurs exclusively by the ribulose diphosphate oxygenase reaction. Such a hypothesis permits the magnitude of photorespired CO_2 released by the conventional glycolate pathway to be no greater than 14 to 20 percent of the net CO_2 fixed (*16*, *17*). Table 2, however, illustrates that by a number of different assays, in different species, and in many laboratories at least 50 percent of the CO_2 assimilated is released and measured during photorespiration, and this is inconsistent with the biochemical scheme presented (*16*). Glycolic acid is synthesized sufficiently rapidly in C_3 species, 70 to 80 μmole per gram of fresh weight per hour (*18*), to account for the results in Table 2.

Table 2. Minimal rate of photorespiration in soybean, sunflower, sugar beet, tobacco, and maize (*13*). The values are minimal and are underestimates because photorespiration is assayed under conditions of high light intensity where the main flux of the gas (CO_2 or O_2) is in the opposite direction.

Method of assay	Temperature (°C)	Net photosynthesis in normal air (mg CO_2/dm²/hour)	Photorespiration (% of net photosynthesis)	Reference
Soybean				
CO_2 release, CO_2-free air*	26	35	46	(*60*)
Postillumination CO_2 burst	25	11	75	(*61*)
CO_2 release, CO_2-free air	30	18	42	(*62*)
Sunflower				
Short-time uptake, $^{14}CO_2$ minus $^{12}CO_2$	25	25	60	(*63*)
$^{14}CO_2$ release, CO_2-free air	25	28	27	(*64*)
Sugar beet				
CO_2 release, CO_2-free air	25	25	47	(*65*)
CO_2 release, CO_2-free air	25	26	40	(*62*)
Tobacco				
CO_2 release, CO_2-free air	25	11	55	(*66*)
Extrapolation of net photosynthesis to "zero" CO_2	25	14	25	(*67*)
Postillumination CO_2 burst	26	17	45	(*68*)
Postillumination CO_2 burst	34	15	66	(*68*)
Maize				
CO_2 release; air passed through leaf	30			(*69*)
CO_2 release, CO_2-free air	35	50		(*62*)
$^{18}O_2$ uptake	31	12	6	(*70*)

* Results are the mean values of 20 varieties recalculated by the authors considering the effects of internal diffusive resistances.

The Synthesis of Glycolic Acid

The rate of glycolic acid synthesis, which occurs largely in leaf chloroplasts, is probably the most important factor controlling photorespiration, but not all of the biochemical reactions responsible for the synthesis of the glycolic acid in any given photosynthetic tissue have been worked out. A num-

ber of reactions are known that produce glycolic acid (Fig. 2), and at least several of these may occur simultaneously.

The important observation was recently made (*19*, *20*) that ribulose-1,5-diphosphate carboxylase, the enzyme primarily responsible for CO_2 uptake during photosynthesis, also catalyzes the reaction between the substrate and O_2 to produce phosphoglycolic and phosphoglyceric acids (Fig. 2, reaction a). The properties of the oxygenase reaction have much in common with the well-known inhibition of photosynthetic CO_2 uptake by O_2 (the Warburg effect) (*16*, *17*). Leaves contain an active phosphoglycolate phosphatase in their chloroplasts (*21*) that could rapidly produce glycolic acid. Such observations have led some investigators to conclude prematurely that the oxygenase reaction can account entirely for the synthesis of glycolic acid and photorespiration.

There are some difficulties in accepting the ribulose-1,5-diphosphate oxygenase reaction as the major pathway of glycolic acid synthesis in photosynthetic tissue. First, the rates of synthesis by this reaction with isolated systems are generally far too slow to accommodate the minimal photorespiratory rates shown in Table 2. Second, in intact leaves in light there was a rapid incorporation of $^{18}O_2$ into the carboxyl groups of glycine and serine (products of glycolic acid metabolism) as expected (*22*). But even in an atmosphere of 100 percent O_2, which would greatly favor the oxygenase, the specific activity of incorporated $^{18}O_2$ was no greater than one third of that supplied, indicating that approximately one third of the glycolate was produced by the oxygenase reaction in 100 percent O_2 and two thirds by some other reaction. Finally, the product of the oxygenase reaction, phosphoglycolic acid, has not yet been shown to function as an important intermediate in vivo in kinetic experiments with $^{14}CO_2$ in either intact tissues or with isolated chloroplasts. From kinetic experiments in which $^{14}CO_2$ was used with *Chlorella* in 100 percent O_2, it was concluded that about one third to one half of the glycolic acid produced could have arisen from phosphoglycolic acid (*23*). Presumably, an even smaller proportion of the glycolic acid would have come from phosphoglycolic acid in normal air than in 100 percent O_2.

Glycolic acid was synthesized in a reconstructed chloroplast system in the light in the presence of a transketolase substrate, such as ribulose 5-phosphate or fructose 6-phosphate, together with transketolase, NADP, and ferredoxin (*24*) (Fig. 2, reaction b). An oxidant, presumably hydrogen peroxide, from the oxidation of reduced ferredoxin or NADPH was generated during illumination and produced glycolic acid from "active glycolaldehyde" at maximal rates about 10 percent of that needed for photorespiration. Additional support for the direct functioning of intermediates of the Calvin cycle in glycolic acid biosynthesis comes from the demonstration that two carbon fragments from added ribose 5-phosphate and fructose 1,6-diphosphate are directly incorporated into glycolic acid in isolated spinach chloroplasts (*25*).

Active glyoxylate reductase enzymes are known to occur in leaves (*3*) (Fig. 2, reaction c), and glyoxylate may be available for glycolate formation from several pathways including the isocitrate lyase reaction (*26*). The compound [2-^{14}C]glyoxylate is easily converted to [2-^{14}C]glycolate by leaves, and organic acids such as [3-^{14}C]pyruvate are incorporated into [2-^{14}C]glycolate in leaf tissues (*18*). Such observations can be explained by the functioning of the glyoxylate reductase reaction.

A direct but still undefined carboxylation reaction may also produce glycolic acid (Fig. 2, reaction d). When $^{14}CO_2$ and an inhibitor of glycolic acid oxidation were supplied together to illuminated leaves, the accumulated glycolic acid carbon atoms had a specific radioactivity that was about 50 percent of that of the $^{14}CO_2$ supplied and was greater than that in the carboxyl-carbon atom of phosphoglyceric acid (*27*), the first product of photosynthesis. This shows that glycolic acid is synthesized rather directly from fixed CO_2. More recently, in studies with $^{14}CO_2$ fixation in illuminated chloroplasts in the absence of any inhibitors, Robinson and Gibbs (*25*) found that the specific radioactivity of the carbon atoms of [^{14}C]glycolate was between 53 and 71 percent of the $^{14}CO_2$ supplied. These experiments also indicate that a rather direct synthesis of glycolic acid from CO_2 is possible.

Multiple pathways, including the reactions above, probably occur in the same tissue. For example, organic acids such as [2-^{14}C]acetate and [3-^{14}C]pyruvate were incorporated into [2-^{14}C]glycolate with a higher specific radioactivity in maize than tobacco leaves, while $^{14}CO_2$ incorporation into glycolate was much better in tobacco than in maize (*18*). The addition of phosphoenolpyru-

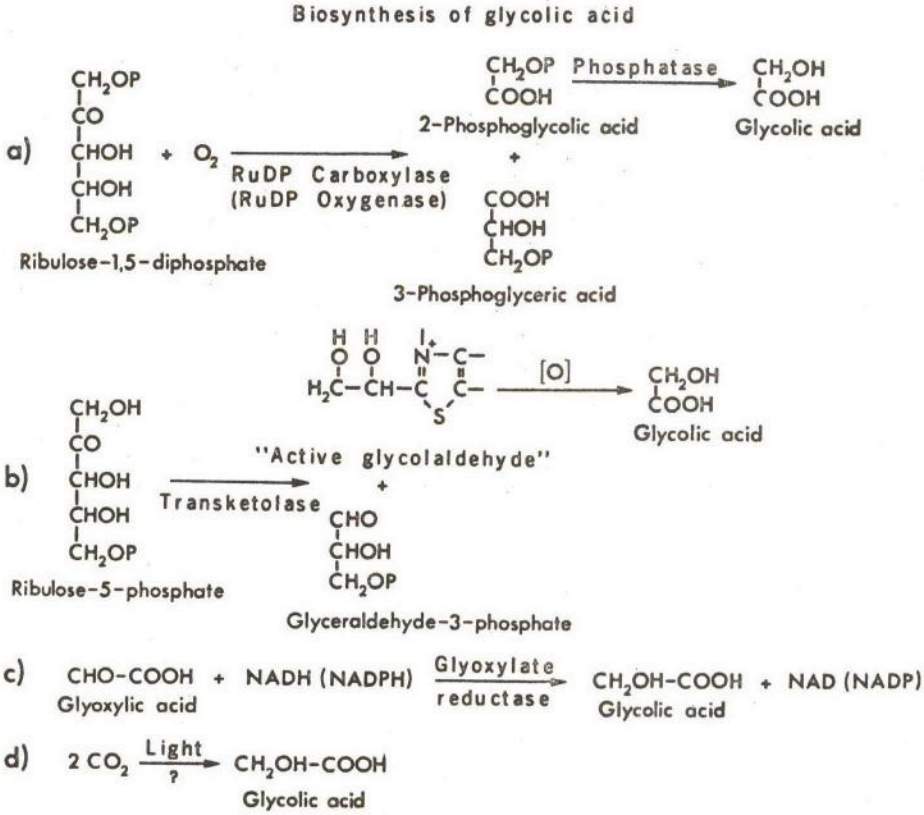

Fig. 2. Multiple biochemical pathways for the synthesis of glycolic acid. The "active glycolaldehyde" shown in reaction b is 2-(α,β-dihydroxyethyl thiamine pyrophosphate).

vate stimulated glycolate synthesis in maize but not in tobacco. Eickenbusch and Beck (*28*) demonstrated the existence of at least two kinds of reactions concerned with glycolic acid synthesis in isolated spinach chloroplasts. The rate of one pathway was unchanged by O_2 concentrations up to that in normal air, while the rate of the second pathway increased linearly when the O_2 concentration was raised above that in the air. Based on changes in the specific radioactivity of various intermediates in maize and sunflower leaves, Mahon *et al.* (*29*) also concluded that there are sources of carbon for glycolate synthesis besides the intermediates of the Calvin cycle.

Glycolic Acid Synthesis and Photorespiration within a Species

When illuminated leaf tissue of a species with rapid photorespiration is placed in a solution of α-hydroxysulfonate, glycolic acid oxidation is blocked and the glycolic acid accumulates at an initial rate (*18*) sufficient to account for the minimal rates of photorespiration shown in Table 2. Under the same conditions, however, maize leaf tissue synthesizes glycolic acid at about one tenth the rate in C_3 species (*14*, *18*).

A possible explanation for the slow synthesis in C_4 species is offered in the next section, but it appears that much of the difference in net photosynthesis between C_3 and C_4 species can be explained by the slow rate of glycolic acid synthesis, and hence slower photorespiration, in the efficient photosynthetic species. Placing plants with rapid photorespiration in atmospheres containing less than 2 percent O_2 or in elevated concentrations of CO_2 (at least 0.2 percent) decreases glycolic acid synthesis, decreases photorespiration, and increases the dry weight yield to a level similar to maize (*3*). It therefore would seem most urgent to learn how to diminish the rate of glycolate production by biochemical or genetic means in normal environments in tissues with rapid rates of photorespiration and thus mimic what occurs normally in maize.

Any environmental condition or biochemical inhibitor that interferes with photosynthesis will of course also inhibit glycolic acid synthesis. A specific biochemical inhibitor of glycolic acid synthesis should also be expected to increase net CO_2 assimilation rather than inhibit it. Goldsworthy (*30*) showed that isonicotinic acid hydrazide inhibits photorespiration in tobacco leaves. This occurs because the inhibitor blocks glycolic acid synthesis (*18*), but the effect of this inhibitor on net photosynthesis has not been examined.

Recently I found that glycidic acid, 2,3-epoxypropionic acid, an epoxide similar in structure to glycolic acid, blocks glycolic acid synthesis and not glycolic acid oxidation in tobacco leaf tissue (*14*). Under conditions where glycolic acid synthesis and photorespiration were slowed by about 50 percent by the inhibitor, net photosynthetic CO_2 fixation was increased similarly, by about 50 percent. The inhibitor also blocked glycolic acid synthesis in maize leaf, but had no effect on CO_2 uptake in this tissue, presumably because maize already synthesizes so little glycolic acid. There was no effect of glycidic acid on the isolated ribulose diphosphate carboxylase (oxygenase) reaction, but the biochemical mechanism for inhibition by glycidic acid has not yet been established. The use of this inhibitor has therefore confirmed in an independent manner that slowing glycolic acid synthesis can result in large increases in net photosynthesis in an inefficient photosynthetic species.

Zelitch and Day (*31*) observed that a yellow-leaved variety of tobacco (JWB mutant) had slower rates of net photosynthesis in normal air and a faster photorespiration than its green-leaved siblings (JWB wild). Since JWB mutant plants were altered by a simple genetic change (albeit with pleiotropic effects in this case), this example demonstrated that genetic control was capable of regulating photorespiration within a species. As predicted by our hypothesis, the variety with a slower rate of photorespiration grew more rapidly in a greenhouse environment.

Wilson (*32*) has observed variations in photorespiration within populations of the grass species *Lolium*. We have described the results of pedigree selections on siblings of several generations of normal-appearing tobacco plants (Havana Seed) with slower than usual photorespiration and faster net photosynthesis than is commonly observed for this species (*33*). Superior plants, on selfing, produced about 25 percent of their progeny with slow photorespiration and fast net CO_2 uptake, but the percentage was not increased in several successive generations. It was clearly established, however, that some plants growing side by side showed about 50 percent of the normal rate of photorespiration, similar rates of dark respiration, and an increased net photosynthesis of about 40 percent. Thus, differences in photorespiration undoubtedly can occur within a species, and innovative genetic methods may be required to fix this characteristic in an entire population.

Natural Regulation of Glycolic Acid Synthesis in C_4 Species

Many investigations support the view that, in the leaves of C_4 species, the first carboxylation reaction occurs in the mesophyll cells and that malate or aspartate is then transported to the specialized bundle sheath cells that surround the vascular tissue in these species (*8*, *34*). The 4-carbon compound is decarboxylated, and the released CO_2 is fixed once more by reactions associated with the Calvin cycle in the bundle sheath cells. There are still a number of uncertainties and controversies about the C_4 pathway (*13*), but one of its main features involves an increase in CO_2 concentration in the bundle sheath cells.

Hatch (*35*) calculated the sizes of the pools of CO_2 and 4-carbon compounds in these two types of cells in maize leaf from short-term labeling experiments using $^{14}CO_2$ followed by $^{12}CO_2$ on the assumption that the CO_2 pool was restricted to the mesophyll or the bundle sheath compartment. In this way he estimated that the CO_2 concentration in bundle sheath cells was five times greater than in the other photosynthetic cells. High concentrations of CO_2 are known to inhibit glycolic acid synthesis (*3*), and the site of glycolic acid formation in C_4 species is believed to occur only in the bundle sheath cells (*34*). Thus species such as maize probably synthesize glycolate slowly because the anatomical and biochemical compartmentation of their specialized photosynthetic cells cooperate to create an inhibitory environment.

The C_4 species seem to have evolved an unnecessarily complicated and indirect biochemical mechanism for inhibiting glycolic acid biosynthesis and slowing photorespiration. Björkman (*36*) was unable to convert a C_3 species into a C_4 species by producing interspecific hybrids in *Atriplex* using parental plants of one type and the other, and the hybrids of this weed had a decreased net photosynthesis. Neither the superior

C_4 anatomy nor a rapid phosphoenolpyruvate carboxylase activity was sufficient to assure the rapid CO_2 uptake characteristic of C_4 plants. Perhaps this is not surprising since a conversion of a C_3 plant into a C_4 would involve large changes in leaf morphology, chloroplast type, and enzyme activities.

It would seem easier to select for a slower photorespiration in the less efficient photosynthetic species by slowing glycolic acid synthesis more directly, and in this way one should expect to obtain large increases in net photosynthesis without invoking the C_4 system. Indeed, examples of decreased rates of photorespiration within a species have been found, as discussed before, and these superior photosynthetic plants do not utilize the C_4 pathway.

The Oxidation of Glycolic Acid and Its Relation to Photorespiration

In order to be further metabolized, glycolic acid must first be oxidized to glyoxylic acid (the apparent reverse of Fig. 2, reaction c), since no other biochemical reaction is known whereby glycolic acid itself reacts. In higher plants, glycolate oxidase is a flavoprotein that couples with O_2, and the reaction rate is very dependent on the O_2 concentration. This enzyme is located mainly in the peroxisomes of green leaves (*37*).

α-Hydroxysulfonates are aldehyde-bisulfite addition compounds and effective competitive inhibitors of glycolate oxidase (*38*). When a suitable sulfonate is supplied to illuminated leaf tissues, glycolic acid accumulates at initial rates sufficient to account for photorespiration in tobacco and sunflower (*18*). Inhibition of glycolate oxidation in tobacco leaf under suitable conditions in the laboratory also blocks photorespiration and brings about large increases in photosynthetic CO_2 uptake, but the sulfonate does not increase photosynthesis in maize leaf (*15*).

A biochemical sequence known as the glycolate pathway of carbohydrate synthesis exists in leaves (*3, 39*), and this pathway provides the photorespired CO_2. As usually depicted, four molecules of glycolic acid (glyoxylic acid) yield one of glucose and two of CO_2; the CO_2 is believed to arise during the step involving the condensation of two glycine molecules to yield serine. The stoichiometry indicated above permits the loss of only 25 percent of the glycolic acid metabolized as CO_2 and, as already shown in Table 2, photorespiratory CO_2 often accounts for at least 50 percent of net CO_2 fixation during photosynthesis. Thus CO_2 cannot be produced during photorespiration from only the decarboxylation of glycine (*3, 13*). The oxidative decarboxylation of glyoxylic acid by hydrogen peroxide yields formic acid and CO_2, and this reaction can be rapid in illuminated chloroplasts (*40*), can also occur in peroxisomes (*41*), and could account for most of the photorespiratory CO_2. The further oxidation of formic acid can also contribute to the CO_2 produced during photorespiration (*15*).

Leaves of all species appear to have activities of glycolate oxidase in excess of that needed for photorespiration (*3*), and an excess of the other enzymes associated with the glycolate pathway as well (*37*). Since glycolic acid must first be oxidized to be further metabolized, controlling the glycolate oxidase activity by genetic means would not seem to be a reasonable means of controlling photorespiration because glycolate would continue to accumulate. If the utilization of an intermediate in the pathway, such as glyoxylate or glycine, were enhanced, less substrate might become available for decarboxylation during photorespiration. Alternatively, it is conceivable that the concentration of some metabolite in the glycolate pathway, even glycolic acid itself, might exercise a feedback inhibition on glycolic acid synthesis, and this property could be utilized to control photorespiration.

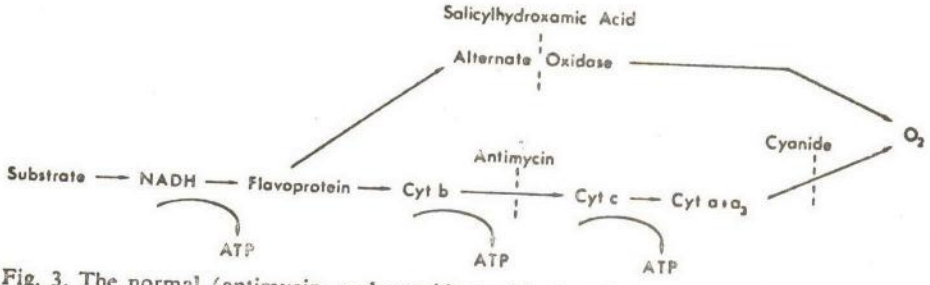

Fig. 3. The normal (antimycin- and cyanide-sensitive) and alternate (salicylhydroxamic acid–sensitive) pathways of electron flow and ATP formation in plant mitochondria (*43*). Abbreviations: NADH, reduced nicotinamide adenine dinucleotide; Cyt, cytochrome.

Dark Respiration and Plant Productivity

The respiration of higher plants that is easily measured in darkness takes place primarily, but not exclusively, in the mitochondria. Its biochemistry is similar in plants, animals, and microorganisms. The process provides ATP, largely from the reactions of oxidative phosphorylation, while substrates are oxidized to CO_2. In microorganisms, ATP production often limits growth, and it may be assumed that this is also often true in higher plants. Respiration also provides carbon compounds that are utilized in many biosynthetic pathways that occur in plant cells.

The rate of respiration in photosynthetic tissues in darkness is usually 5 to 10 percent of the CO_2 assimilation in bright light. The lower leaves in a crop are shaded to various degrees and may carry out little photosynthesis, and respiration also occurs in stems, roots, and fruits that usually fix little or no CO_2. There is excellent evidence (*3*) that the reactions of "dark" respiration occur just as rapidly in the light as they do in photosynthetic tissues in darkness, and values in the literature show that 29 to 71 percent of the gross CO_2 fixed during photosynthesis may be lost by the process of dark respiration (*3*).

If part of the dark respiration were wasteful, eliminating it would also bring about large increases in plant productivity. Therefore, it is important to establish how much of the dark respiration is coupled to useful synthetic and growth processes, and what portion might be eliminated. Eliminating wasteful dark respiration might also increase the productivity in the efficient photosynthetic species such as maize.

One well-documented example of a wasteful dark respiration in maize has been described by Heichel (*42*), who compared the net CO_2 exchange and dry weight increase of two inbred varieties grown in the same environment. One variety showed about 50 percent faster gain in dry weight although the rates of net CO_2 assimilation were similar. The faster growing variety lost 26 percent of its gross CO_2 uptake

Table 3. Photosynthetic activity of plant cultures. L/D values are ratios of the rate of $^{14}CO_2$ uptake in the light to the rate of uptake in the dark.

Species	Carbon source for growth	Growth illumination (lux)	Chlorophyll content (μg/g fresh weight)	Demonstration of photosynthesis	Reference
Carrot	1 percent CO_2 in air	10,000	50	40 μmole CO_2 per milligram of chlorophyll per hour	(47)
		2,000		L/D = 6.0	(71)
Ruta graveolens	1 percent CO_2 in 99 percent N_2	6,000	57	L/D = 13.0	(49)
Atropa belladonna	Sucrose	7,000		113 μmole CO_2 per gram fresh weight per hour	(72)
Froelichia gracilis	Sucrose				
Tobacco	2 percent CO_2 in air	900–1,700	61	500 μmole O_2 per milligram of chlorophyll per hour	(48)
		5,400	27	L/D = 7.0	(50)
Tobacco	Sucrose	1,500	13	Delayed chlorophyll fluorescence	(51)
Tobacco	Sucrose	4,000		L/D = 9.0	(73)
Tobacco	0.03 percent CO_2 in air	4,000		L/D = 2.0	
	Sucrose	4,000	25	120 μmole CO_2 per milligram of chlorophyll per hour	(73)
Tobacco	0.03 percent CO_2 in air	4,000	15	85 μmole CO_2 per milligram of chlorophyll per hour	
	Sucrose				

during respiration in the dark as compared with 33 percent in the poorer variety. In this example, an appreciable portion of the dark respiration was clearly wasted in the slower growing inbred.

Several possible biochemical explanations could account for a potentially wasteful dark respiration. Some of the respiration may occur by oxidases outside the mitochondria which may not produce ATP, or the oxidations within the mitochondria might not be tightly coupled to ATP synthesis. Finally, it seems likely that some portion of mitochondrial respiration occurs by the recently discovered alternate pathway of electron transport in mitochondria, which produces only one third as much ATP for each pair of hydrogen atoms oxidized as does the conventional pathway (see Fig. 3). This alternate pathway is under genetic control in fungi (*43*) (it is the main pathway in "poky" or slow growing *Neurospora* mutants) and it occurs in higher plants (*44*).

The alternate pathway of respiration is insensitive to antimycin and cyanide, and is specifically inhibited by salicylhydroxamic acid, which does not affect the conventional electron transport system. In isolated mitochondria from a number of plant species and tissues, under conditions of rapid respiration and phosphorylation, the alternate pathway contributed from 1.0 to 100 percent of the respiration, with a value of 15 to 20 percent being most often observed (*44*). Mitochondria from leaves were not examined in this investigation, but it is well known that 50 percent or more of the dark respiration in leaves is cyanide-insensitive (*45*) and presumably occurs by the alternate pathway. Thus, eliminating the alternate pathway, by producing mutants in plant tissue cultures, might be expected to result in greater plant productivity.

The Use of Tissue Cultures to Obtain Desirable Mutants

Recent advances in somatic cell genetics in higher plants (*4*) (see the article by Carlson and Polacco (*4a*) suggest the usefulness of screening large populations of haploid plant cells so that only the desired phenotype (low rates of photorespiration or more efficient dark respiration, for example) will survive. Intact normal plants in which both gene copies will be identical can already be obtained by this technique in many species. The main problem at present is learning how to screen for the desired mutants possessing increased net photosynthesis or productivity, and this approach is now being actively pursued here at our station and undoubtedly elsewhere.

One obvious approach would be to devise selection methods for superior CO_2 uptake in illuminated plant tissue cultures grown on CO_2 as the carbon source, with the hope that such a phenotype would be expressed in the intact plant. Most experienced investigators seem to agree with the statement expressed by Gautheret (*46*) that tissue cultures will not grow on CO_2 alone as a carbon source. There are more recent indications, however, that some cultures can grow on CO_2 and that even cultures grown on sucrose in the light also assimilate some CO_2 photosynthetically (Table 3). Whether cultures can be maintained indefinitely under autotrophic conditions is still not clear. With carrot tissue (*47*) the cells did not survive more than 2 weeks on CO_2, but Chandler *et al.* (*48*) apparently grew tobacco cultures for a considerable time on CO_2 without them differentiating. Light is essential for chloroplast formation and chlorophyll synthesis in tissue cultures (*47*, *49–51*), and Koth (*52*) recently showed that ribulose diphosphate carboxylase activity was present in tobacco cultures after transfer of the tissue to light and that the increase in enzyme activity accompanies the increase in chlorophyll.

An alternative approach would be to select for decreased photorespiration in haploid tissue cultures grown on sucrose by obtaining mutants with decreased rates of glycolic acid synthesis or possessing a more efficient utilization or regulation of intermediates of the glycolate pathway of carbohydrate synthesis. Attempts to achieve this are being made in our laboratory, and Carlson and Polacco (*4a*) describe some experiments with plant tissue cultures aimed at eliminating the inefficient alternate pathway of dark respiration described earlier.

This use of tissue cultures and the application of our knowledge of the biochemistry of carbon compounds related to photosynthesis would seem to offer the greatest promise of enabling us to find methods for increasing productivity in a number of crops. The potential importance of regulating wasteful respiratory processes, as discussed here, represents only one of a number of biochemical strategies that might be applied to the problems of world food production in the future.

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Nitrogen Fixation Research: A Key to World Food?

Investigators in a variety of disciplines are searching for new technologies for producing fixed nitrogen.

R. W. F. Hardy and U. D. Havelka

Population growth and changes in dietary habits accompanying economic growth will more than double the demand for agronomic crops during this quarter century. Among the many factors that could contribute to improving crop yields, increasing the availability of fixed nitrogen to crops is probably of the greatest importance. In the absence of alternative technologies for producing fixed nitrogen, about 200 × 10^6 metric tons of fertilizer nitrogen will be required annually by the end of this quarter century. In 1974, 40 × 10^6 tons of fertilizer nitrogen with an approximate value of $8 billion were used, as opposed to the 3.5 × 10^6 tons that were used annually 25 years ago.

The recent scarcity of nitrogen fertilizers, the high energy requirement for their manufacture, and, most significantly, their increased selling price have produced a tremendous interest in the search for alternative technologies. This interest has permeated even the popular literature, as documented by the following quotation from *Harper's Magazine*, by Horace Freeland Judson (*1*):

> . . . a biologist working in Brazil, said she has found several kinds of tropical grasses that grow in symbiosis with N_2-fixing bacteria of a new kind in their roots. Could such bacteria be persuaded to live with one of the new high yield tropical climate grains by modifying the

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genetic makeup of bacteria or the grains? Cereals that could provide their own fertilizer are beyond doubt the biggest prize of all in the gift of the new biology —far bigger in terms of lives to be saved than even the conquest of cancer or a cow that could digest sawdust.

In this article (*2*) we assess the need for fixed nitrogen for crop production and summarize the advances in chemical and biological research on nitrogen fixation that may, in the long run, lead to the development of alternative technologies for providing fixed nitrogen. There have been many significant research advances in the chemistry and biology of nitrogen fixation during the past 15 years (*3–8*). The breadth of the objectives of current research includes the enhancement of symbiotic nitrogen fixation by grain legumes; the domestication of associative symbioses for cereals; the development of abiological nitrogen-fixing systems with high rates of nitrogen fixation under mild conditions; the extension of rhizobial infection or the development of man-made associative symbioses for cereals; and the transfer of the genetic information for nitrogen fixation to cereals. However, no advance has produced a new technology that is suitable for direct application to high-yield crop production. Until alternative technologies are in hand, it is critical that the production of fertilizer nitrogen continue to be increased throughout the world.

Need for Fixed Nitrogen for Crops

The need for increased nitrogen input and the desire, but not the necessity, to seek alternative technologies are based on a variety of factors, for example, population growth, the limited availability of additional arable land, changing dietary habits with economic growth, cereal-grain and grain-legume production trends, the current contribution of biological and abiological nitrogen fixation to crop production, and the limitations and potentials of these nitrogen input systems (*2*).

We believe that efforts to seek alternative technologies for nitrogen fixation should emphasize the abiological or biological approaches that would be applicable to cereal grains and grain legumes. Cereal grains are the major source of food, with current annual production being about 1300×10^6 tons worldwide (*9*). Of the nonbiological inputs responsible for the increased cereal yields, the increased use of fertilizer nitrogen is probably the most important single factor. Cereal-grain yield is correlated directly to the consumption of fertilizer nitrogen divided by the area under cereal cultivation for both the more developed countries and the less developed countries during the last 20 years (Fig. 1), there being no major discontinuity between the data for the more developed and less developed countries. Current cereal-grain yield and total fertilizer nitrogen use divided by the area used for cereal cultivation in the less developed countries is almost identical to that for the more developed countries about 20 years ago. These data document the key role of additional inputs of fixed nitrogen for increasing crop production.

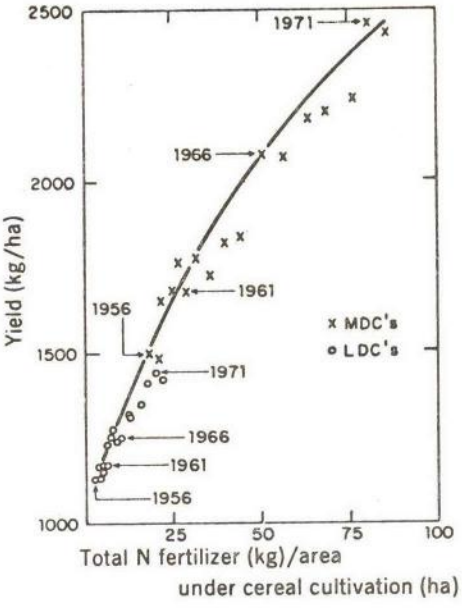

Fig. 1. The relationship between the use of nitrogenous fertilizers and the yield of cereal grains during the last 15 years for both more developed (MDC's) and less developed countries (LDC's) (*2*). Note that the total nitrogen fertilizer use is divided by the area under cultivation with cereal grain; actual rates would be about one-half since about one-half of fertilizer nitrogen is used for cereal grain production. [From Hardy (*2*), courtesy of Washington State University Press]

The grain legumes have failed to show a major yield increase in response to the application of fertilizer nitrogen. World production of grain legumes is about 115×10^6 tons, with soybeans accounting for almost one-half of this quantity, followed by peanuts, dry beans, and dry peas (*9*, *10*). The grain legumes are important sources of protein both for direct consumption by humans in several of the less developed countries and for the feeding of animals in the more developed countries. The amount of protein in the seeds of these crops ranges from 20 to 45 percent, as opposed to the cereal grains that contain 8 to 20 percent of protein. However, world production of grain legumes is only 10 percent of cereal grains and production area is about 15 percent (Fig. 2). In several of the less developed countries, the area allocated to the protein-rich, but less profitable, grain legumes has decreased with the extra area allocated to the low-protein, but more profitable, cereal grains. About one-third of the world production of grain legumes in recent years has come from soybeans grown in the United States. This crop has undergone a fivefold increase in total production in the United States in the last 25 years as a result of a fourfold increase in production area and a modest increase in yield. These data emphasize our failure to develop technology for major improvements in the yields of grain legumes. Undoubtedly, the development of a technology for increasing the nitrogen input to these crops will be a key to increasing their yields, because they require up to four times as much nitrogen per unit of yield as do cereals. For example, a corn crop yielding 100 bushels per acre consumes 150 pounds of nitrogen while a soybean crop with the same yield would consume 600 pounds of nitrogen. The ability of legumes to fix at least part of their nitrogen requirements biologically should not be ignored in seeking solutions to increased nitrogen input, and the higher protein content of nitrogen-fixing as opposed to non-nitrogen-fixing legumes may be of significance (*11*). At the same time, solutions utilizing abiological inputs should not be ignored. Economics will be the major factor that dictates the successful solution.

Potentials and Limitations of the Nitrogen Input Systems

The industrial fixation of nitrogen by the Haber-Bosch process currently provides about 40×10^6 tons of nitrogen, while the other abiological processes, lightning, combustion, and ozonization, are estimated to fix about 10, 20, and 15×10^6 tons of nitrogen, respectively, each year (*3*). The amount of nitrogen fixed biologically is difficult to estimate because of the heterogeneity of nitrogen-fixing organisms, the heterogeneity of their distribution, the heterogeneity of the environment in

which they function, and our extremely limited but improving data base. A most recent estimate of 175×10^6 tons of nitrogen fixed per annum assigns 90×10^6 tons to the amount fixed in agricultural soil (*3*). This estimate will require modification as the data base expands; it may well be too low since it was generated from a conservative approach, although it is about 75 percent greater than a previously widely quoted estimate made about a decade earlier. Regardless of the actual amount of nitrogen that is fixed biologically, the value has not changed substantially over the last 25 years and thus it is clear that biological nitrogen fixation has not contributed to the increase in crop productivity but has, at best, only maintained the unimproved base production.

The Haber-Bosch process converts nitrogen to ammonia under conditions of high temperature and pressure in highly engineered plants with capacities of 1000 tons of nitrogen per day. Both the manufacturing process and the utilization of nitrogenous fertilizers have some inherent limitations. A major part of the cost of manufacture is capital cost; a plant with a capacity of 1000 tons per day together with its associated facilities requires an investment approaching $100 million (*12*). Moreover in the less developed countries these plants operate at about one-half of their rated capacity. Transportation, storage, and application costs are high for fertilizer nitrogen in the more developed countries and there are additional problems in the less developed countries where transportation systems are often adequate. Prior to 1973, the cost of transportation, storage, and application approached that of manufacture. On the average, crops recover and utilize only about 50 percent of applied nitrogenous fertilizer. Of the large commercial energy input used to produce a crop of corn in the United States, about one-third is required to manufacture, distribute, and apply the fertilizer nitrogen (*13*). However, the ratio of additional food energy produced by the application of 50 to 200 kg of nitrogen per hectare of corn to the energy used to produce, transport, and apply the fertilizer nitrogen is still a favorable 5 to 8 (*14*). Although it is clear that there is a need for improved alternative technologies, the need is not absolute because presumably 500 to 600 large fertilizer nitrogen plants operating at capacity could satisfy the nitrogen needs for crop production in A.D. 2000.

In contrast to the abiological process that occurs in a single type of chemical plant there is a diversity of biological nitrogen-fixing organisms and relationships (*3*). The relationships extend from asymbiotic to obligatory symbiotic, with various associative symbioses in between (Fig. 3). Asymbiotic diazotrophs (nitrogen-fixing organisms), which include some bacteria and the blue-green algae, fix nitrogen independently of other organisms. Both natural and synthetic diazotrophs are known, a strain of nitrogen-fixing *Escherichia coli* having recently been produced.

The obligatory symbiotic diazotrophs are exemplified by bacteria of the genus *Rhizobium* that occur in the root nodules of legumes and unidentified microorganisms in the nodules of some nonleguminous angiosperms. In the case of the *Rhizobium*-legume symbiosis, each of the partners is ineffective in nitrogen fixation alone in its normal environment but is effective in the symbiotic relationship. Two exceptions to this general statement were recently demonstrated: a *Rhizobium* strain was found to produce a nitrogen-fixing nodule on a nonleguminous plant, *Trema canabina* (*15*); and simple factors derived from nonleguminous as well as leguminous plant cells appeared to enable some free-living *Rhizobium* strains to express a low level of nitrogen-fixing activity (*16*). The *Rhizobium*-legume symbiosis is estimated to contribute 40×10^6 tons of nitrogen annually to grain legumes as well as a major part of the 40×10^6 tons of nitrogen fixed in permanent meadows. In the other naturally occurring obligatory symbioses, various nonleguminous angiosperms and a microorganism presumed to be an actinomycete form a symbiotic association that is important to forest crops but is not of major significance to agronomic crop production.

In associative symbiotic relationships, one of the two partners is an asymbiotic diazotroph. The nondiazotroph may provide an environment that is favorable for nitrogen fixation by the diazotroph. The importance of these associative symbioses is only currently being recognized and they

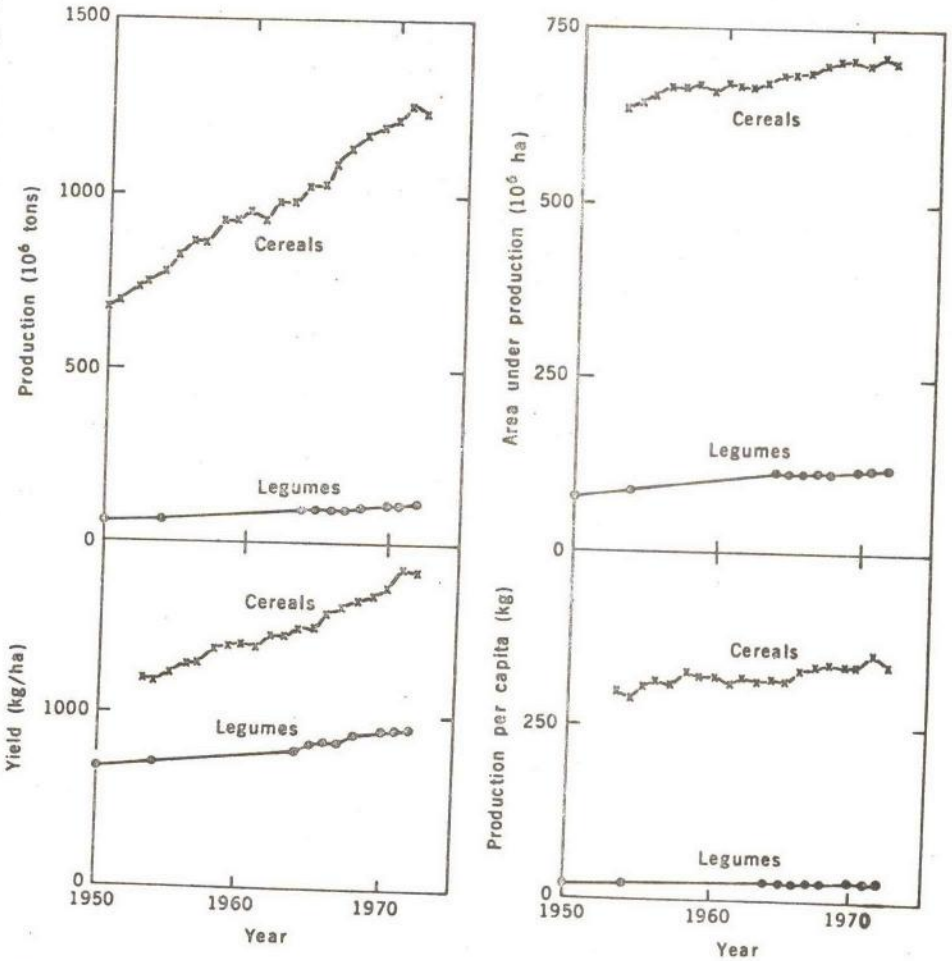

Fig. 2. Comparison of trends in world production of cereal grains and grain legumes, production area, yield, and production per capita (*2*, *9*). [From Hardy (*2*), courtesy of Washington State University Press]

may well contribute a major amount of fixed nitrogen to crop production.

Which types of nitrogen-fixing relationships should we attempt to develop for increasing nitrogen input to crops? In general, those relationships in which the site of nitrogen fixation is located on or in the plant will permit direct and thereby efficient coupling of the fixed nitrogen to the plant in amounts that parallel the changing needs of the plant throughout its complete growth cycle. Any of the obligatory and associative symbioses in which the crop plant is one of the symbiotic partners would meet these requirements, as would crop plants containing the genetic information for nitrogen fixation. Abiological systems with improved coupling of nitrogen to the plant might also be suitable for development. Free-living bacteria and blue-green algae do not meet the requirements nor do symbioses of bacteria or algae with noncrop plants.

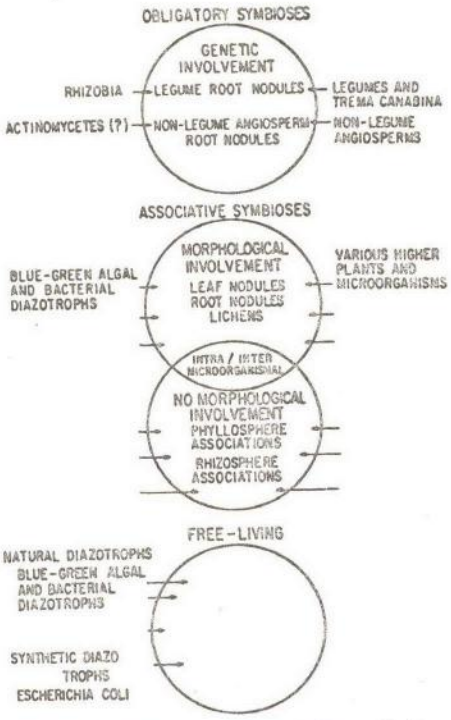

Fig. 3. Biological nitrogen-fixing relationships. [From Burns and Hardy (*3*), courtesy of Springer-Verlag, New York]

Advances in the Chemistry of Nitrogen Fixation

The molecular era of nitrogen-fixation research was initiated by three independent discoveries in three different countries, the United States, the Soviet Union, and Canada. One discovery concerned biological nitrogen fixation while the other two were purely abiological.

Nitrogen fixation by nitrogenase. In 1960 a functional nitrogen-fixing enzyme, nitrogenase, was extracted from the anaerobic bacterium, *Clostridium pasteurianum* (*17*). The addition of an inordinately large amount of pyruvate to the incubation medium was the key to this scientific achievement. Nitrogenase, which may constitute up to 5 percent of the cellular protein, has now been isolated from most other physiological classes of nitrogen-fixing organisms including aerobic bacteria, facultative anaerobic bacteria, photosynthetic bacteria, blue-green algae, and legume symbionts, but not from nonleguminous angiosperm symbionts. Nitrogenases from three or four different sources representing different physiological types have been carefully characterized (*18*). The results suggest commonality among nitrogenases with only small differences, thereby justifying a unified description of a single nitrogenase (*4*).

Nitrogenase can be fractionated into two components, one that contains molybdenum and iron and is designated Mo-Fe protein, and another that contains iron and is designated Fe protein (Fig. 4). The Mo-Fe protein has been crystallized (*19*), but the x-ray structure has not been reported. This protein is composed of four subunits arranged to form a parallelepiped as observed in electron micrographs; it contains two molybdenum and 24 to 32 iron and sulfide atoms per 220,000 daltons. A molybdenum-containing prosthetic group common to both nitrate reductase and nitrogenase has been suggested (*20*) and there are some genetic and biochemical data in support of this concept. The Fe protein is composed of two identical ellipsoidal subunits; it contains four iron and four sulfur atoms per 60,000 daltons. The chemical and physical characteristics of each protein have been determined. The electron spin resonance (ESR) spectrum of the Mo-Fe protein is unique with resonances at g values of 2.01, 3.67, and 4.3 attributed to some of the iron atoms. This spectrum has proved useful for studies of mechanism and for physiological studies (*21*). The ESR spectrum of the Fe protein is not unique but is similar to that observed for ferredoxins. Both components are essential for nitrogenase activity with a ratio of one or two Fe proteins for each Mo-Fe protein. In several but not all tested cases, the Mo-Fe protein isolated from one organism can be recombined with the Fe protein isolated from another organism to produce a functional nitrogenase, further supporting the similarity of nitrogenases from different sources.

Ammonia is the product of biological nitrogen fixation with there being no evidence for enzyme-free intermediates; ammonia is not an inhibitor of the reaction. Both adenosine triphosphate (ATP) and a suitable reductant (*22*) are essential for nitrogenase activity with the requirement of four ATP molecules for each two electrons transferred by nitrogenase (*23*). This unusually large energy requirement for nitrogen fixation is surprising because the overall reaction is energy yielding:

$$3H_2 + N_2 \rightarrow 2NH_3;\ \Delta F = -7.95 \text{ kcal/mole}$$

Unfortunately, the enzymatic nitrogen-fixing reaction is extremely inefficient and demonstrates that the evolutionary process has been no more conserving of energy than has man in his development of abiological nitrogen-fixing processes. Ferredoxins or flavodoxins that have redox potentials in the vicinity of the hydrogen electrode are the only known physiological electron-transferring agents that couple to nitrogenase, while hydrosulfite has been useful for studies in vitro (*24*); natural electron donors have been identified in only a few organisms such as *Clostridium* which utilizes pyruvate, while the donor in the agronomically important legume microsymbionts can only be suggested to be reduced nicotinamide adenine dinucleotide phosphate which supports a very low rate of nitrogen fixation by *Rhizobium* nitrogenase. Additional definition of this ancillary part of the nitrogen-fixation system is needed.

The nitrogen-fixing enzyme has an unusual versatility with respect to its ability to reduce a wide variety of substrates (*25, 26*). This versatility, which has proved quite useful with nitrogenase, is turning out to be common among enzymes that utilize small molecules and are involved in vital fixing reactions. Nitrogenase was the first example to be discovered and exhibits by far the greatest versatility. More recently, ribulose bisphosphate carboxylase was found to react with oxygen as well as carbon dioxide (*27*), and in this case the versatility appears to be an evolutionary disaster for most agronomic crops. For both of these enzymes, the versatility was probably no disadvantage at the time of their origin. For nitrogenase, the versatility may still be

of no consequence because none of the alternative substrates are present in sufficient quantities in the atmosphere to compete with nitrogen. On the other hand, the ratio of carbon dioxide to oxygen in the atmosphere has decreased over the years so that oxygen now effectively competes with CO_2 for the CO_2-fixing enzyme.

Nitrogenase can be considered as a reductase for H_3O^+ and for triple or potential triple bonds formed by NN, NO, NC, and CC functions represented by N_2, N_3^-, N_2O, RCN, RNC, and RCCH to give products representing 2, 4, 6, 8, 10, 12, and 14 electron-addition products (Fig. 5). Several of the substrate reductions catalyzed by nitrogenase were novel reactions at the time of their discovery, but subsequent work with abiological systems has duplicated in a qualitative way all of the reactions. Reduction of nitrogen is competitively inhibited by hydrogen and reduction of all substrates except that H_3O^+ is inhibited by carbon monoxide while the interaction between substrates may be more complex. Formation of HD from deuterium and water occurs during the reduction of nitrogen but not of other substrates.

Physical, metal-substitution, binding, and product studies are being used to unravel the dynamics of the nitrogenase reaction. A complex of Mg and ATP binds to the Fe protein but not the Mo-Fe protein. Changes in the ESR spectrum of the Fe and Mo-Fe protein have led to the conclusion that the Mo-Fe protein is reduced by the Fe protein with involvement of Mg · ATP (*21*). The products formed by nitrogenase reconstituted from Fe and Mo-Fe proteins from different sources are dictated by the Mo-Fe protein. Although physical methods have not been useful for following molybdenum during nitrogenase reactions, the kinetics of nitrogenase isolated from cells grown on vanadium in place of molybdenum implicate molybdenum at the active site; differences and similarities between substrates and products are used to interpret the role of molybdenum in complexation and reduction (*28*). Investigations of this type coupled with comparisons of substrate analogs and inhibitors have led to the proposal of a bimetal site of molybdenum and iron bridged by sulfur. Initial complex formation of nitrogen is suggested to occur with iron, followed by subsequent reduction involving both the molybdenum and iron to form, in sequence, metal-bound diazene, hydrazine, and ammonia, with release of the ammonia (*5*, *6*). Additional studies of the nitrogenase reaction are needed to define further the active site and might include nuclear magnetic resonance studies with ^{13}C-, ^{15}N-, or ^{31}P-labeled substrates as well as infrared studies with carbon monoxide.

Although structures of nitrogenase or its component proteins based on x-ray analysis have not been obtained, x-ray structures have been reported for the electron-transferring proteins, ferredoxin, and flavodoxin (*29*). Moreover, synthetic analogs of Fe_4S_4 clusters of ferredoxin have been made (*30*) and they show remarkable chemical and physical similarity to ferredoxin, although their relative insolubility in water precluded the use of the original models in biological systems. Most of the iron and sulfur of nitrogenase is probably of the ferredoxin type but, in addition, other types of iron as well as molybdenum are present. Obviously much more nitrogenase biochemistry will have to be uncovered before we will be able to describe the enzyme and its reaction at a molecular level. Such information may be useful to the chemist and biologist as well as satisfying one's curiosity about the detailed mechanism of this vital enzyme.

The inefficiency of nitrogenase and our inability to circumvent its ATP requirement essentially eliminates any possibility of direct utilization of the unmodified enzyme as a catalyst. Nevertheless, the fundamental biochemical studies have been justified already by a nonpredictable outcome that is making a most significant impact on all investigations of nitrogen fixation. The substrate versatility of nitrogenase and, specifically, the reduction of acetylene to ethylene coupled with gas chroma-

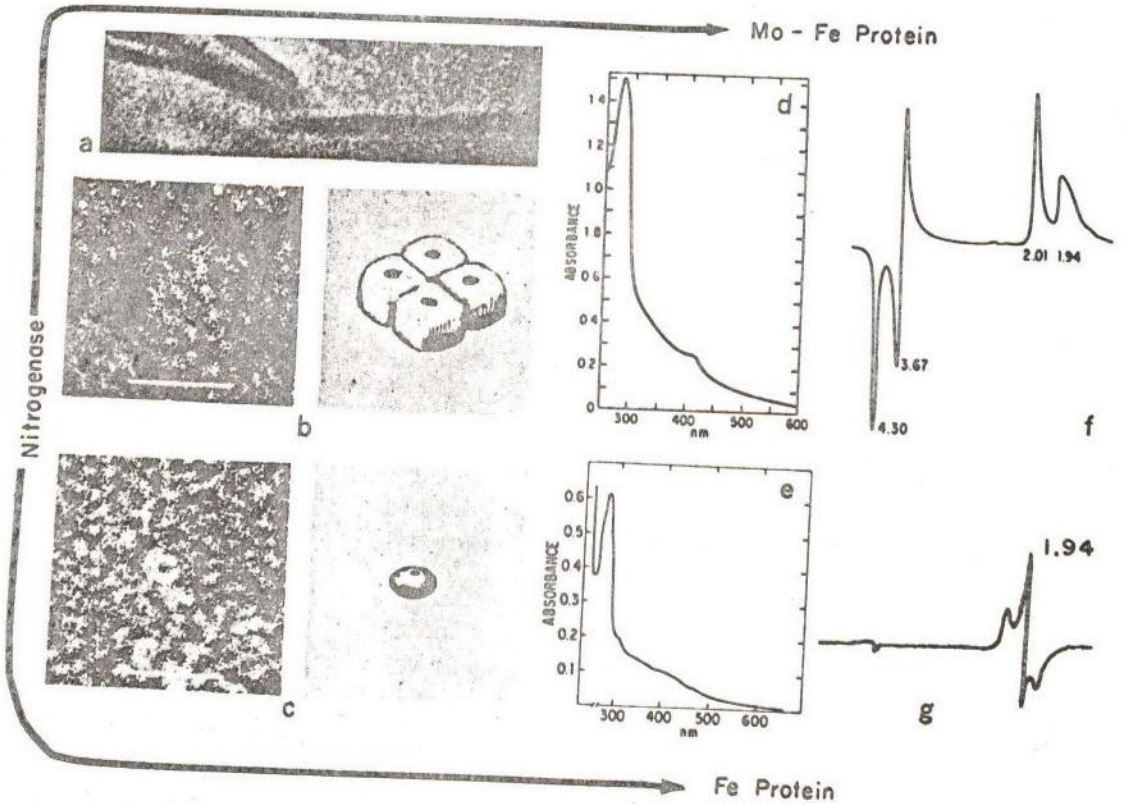

Fig. 4. Nitrogenase and the characteristics of its component proteins, Mo-Fe and Fe protein. (a) Light micrograph of crystalline *Azotobacter* Mo-Fe protein; (b and c) electron micrographs of negatively stained *Azotobacter* Mo-Fe and Fe proteins and models of each protein; (d and e) ultraviolet visible spectra of *Azotobacter* Mo-Fe protein and *Clostridium* Fe protein; and (f and g) ESR spectra of *Azotobacter* Mo-Fe protein and *Clostridium* Fe protein. [From Hardy and Burns (*4*), courtesy of Academic Press, New York]

tographic analysis was proposed (*26*), and has been broadly implemented, as a facile assay for nitrogen-fixing activity (*31*). The present thrust in genetic, physiological, and agronomic studies of nitrogen fixation would have been almost impossible without this assay.

Developments in Abiological Nitrogen Fixation

The modern abiological studies of nitrogen fixation are based on two developments in the early 1960's, each of which has led to the reduction of nitrogen to ammonia under mild conditions. One development was the serendipitous discovery of a ruthenium-nitrogen complex (*32*). This finding was expanded to include most other transition metals with the types of complexes represented by $M \cdot N_2$, $M(N_2)_2$, and $M \cdot N_2 \cdot M$. The initial hopes for reactivity of nitrogen in the isolated complexes were not fulfilled, with little or no reactivity observed, other than loss of nitrogen. Enthusiasm increased with the demonstration of the reaction of a rhenium-nitrogen complex with molybdenum to produce a ReN_2Mo species that was suggested as a model for the initial step in the nitrogenase reaction (*33*). Unfortunately, no further reaction was obtained. Finally, treatment of the bis-dinitrogen complex of either molybdenum or tungsten with hydrochloric acid produced diazene and hydrazine and, within recent months, treatments with aqueous acids such as sulfuric acid have produced ammonia (*34*). These reactions are noncatalytic and somewhat less than stoichiometric at this time.

In the other development, nitrogen was fixed to ammonia under mild conditions with the use of a soluble complex of a transition metal such as titanium, molybdenum, or iron and strong reducing agents such as alkyl metal halides, lithium aluminum hydride, or sodium naphthalide in aprotic media (*35*). Subsequently, such reactions have been demonstrated in protic media with molybdenum, vanadium, or iron complexes reduced by borohydride, hydrosulfite, or V^{2+} (*36*). One of these systems composed of molybdenum, thiol agent, and reductant duplicates all of the substrate reactions catalyzed by nitrogenase with a remarkable qualitative similarity. However, the rate of nitrogen fixation by this system is only 10^{-6} of that of nitrogenase, with the comparisons based on molybdenum content; the low turnover rate of 100 to 200 moles of nitrogen fixed per mole of nitrogenase per minute for nitrogenase emphasizes further the extremely low activity of these abiological systems. This same system has been employed in a laboratory experiment to demonstrate a method of improving the coupling of nitrogen to a crop utilizing an abiological system (*37*). Membrane fractionation of air was used to produce nitrogen-enriched air which was reduced by a membrane-enclosed catalyst, with subsequent permeation to remove the ammonia but retain the catalyst. Such a system in an irrigation stream could represent a feasible method for utilizing nitrogen-fixing catalysts that function in an aqueous environment.

A homogeneous or heterogeneous catalyst that converted molecular nitrogen to fixed nitrogen at high rates under mild conditions and in protic media might have use in the production of fixed nitrogen for agricultural crops. Such a system might improve the coupling of nitrogen to the crop; it might also help to decrease capital costs. The extremely low rates of current systems eliminate their utility until improvements of several orders of magnitude are achieved.

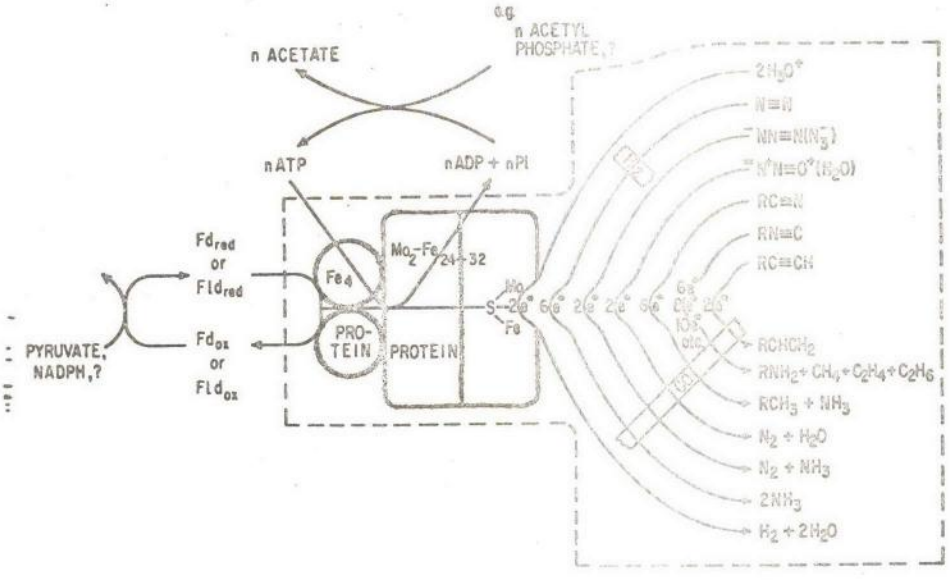

Fig. 5. Schematic diagram of the nitrogenase reaction (enclosed with dashed line) indicating substrates, products, inhibitors, natural electron donors (*Fd*, ferredoxin; *Fld*, flavodoxin), and energy source. The nitrogenase enzyme is represented as a complex of the Fe protein and Mo-Fe protein with Mg · ATP involved in electron transfer from the Fe protein to the Mo-Fe protein. [From Hardy and Burns (*4*), courtesy of Academic Press, New York]

Advances in the Biology of Nitrogen Fixation

Studies of biological nitrogen fixation prior to 1960 were restricted to the organismic level. These investigations, which provided a variety of useful information, included the identification of organisms that fix nitrogen; morphological description of infection and development of rhizobial-legume symbiosis; specificity in rhizobial-legume interactions; the discovery of leghemoglobin and the direct relationship between leghemoglobin content in the nodule and nitrogen-fixing activity; a few measurements of nitrogen-fixing activity in situ; the high ratio (about 40 : 1) of carbohydrate consumed to the amount of nitrogen fixed by free-living organisms; the indirect identification of ammonia as the first product of nitrogen fixation; the inhibition of nitrogen-fixing activity by ammonia and hydrogen; the co-occurrence of nitrogenase and hydrogenase; the low Michaelis constant (K_m) of nitrogenase for nitrogen; and the requirement for additional molybdenum and iron for nitrogen fixation as opposed to the utilization of fixed nitrogen. Investigations at the cellular level subsided in the early 1960's as attention was focused on the molecular studies. Development of the acetylene-ethylene assay reinitiated a much expanded exploration of the biological area in a more definitive manner with physi-

ological, agronomic, and genetic approaches.

Physiological research advances that are relevant to the problem of nitrogen input to crops include definition of nitrogen-fixing organisms, elucidation of systems for the protection of nitrogenase from oxygen, determination of the energy cost of biological nitrogen fixation, information on the incorporation of ammonia into organic compounds, and the promiscuity of cowpea *Rhizobium* including their expression of nitrogen fixation outside of a plant cell.

The list of organisms that fix nitrogen has been redefined with deletion of some previous examples and addition of new ones. The following correlation has emerged. Nitrogenase has only been found in prokaryotic cells including the *Rhizobium* form in root nodules of legumes (*38*); the significance, if any, of the prokaryotic restriction remains to be discovered. The genetic information for nitrogenase also appears to be contained in the rhizobial component and not the leume.

Nitrogenase is an extremely oxygen-sensitive enzyme and this limitation may be one of the major barriers to the development of new nitrogen input systems utilizing a biological approach. For example, a purified Fe protein loses one-half of its activity after less than a 1-minute exposure to air. Facultative nitrogen-fixing organisms such as *Klebsiella* or *Bacillus* do not produce nitrogenase until the environment is almost anaerobic, and nitrogen-fixing photosynthetic organisms only produce nitrogenase under anaerobic ıditions. Special cellular architecture or reactions occur when nitrogenase is in aerobic organisms. *Azotobacter* is proposed to utilize elevated respiratory rates to decrease its internal oxygen pressure (pO_2) and, in addition, at elevated pO_2 nitrogenase may undergo a reversible conformational change to an inactive form for protection against oxygen (*39*). It has been speculated that hydrogen produced from H_3O^+ by nitrogenase may be coupled to hydrogenase as another oxygen-protective system. Most but not all nitrogen-fixing algae contain specialized cells called heterocysts where nitrogenase is localized; heterocysts provide a more reduced environment in which the oxygen-evolving reaction of photosynthesis does not occur (*40*). The nitrogen-fixing activity of aerobic algae and bacteria is increased under subatmospheric pO_2, and an advantage of associative symbioses for these aerobic organisms may be the provision by the higher plant symbiont of an environment with a reduced pO_2. The nitrogen-fixing symbionts of legumes function in an aerobic environment, but the pO_2 within the nodule where they are located is very low; leghemoglobin which is located outside the microsymbionts can facilitate the rate of diffusion of oxygen at a low pO_2, thereby providing oxygen for respiration to form the ATP necessary for the activities of nitrogenase and other enzymes (*41*). Related to the oxygen problem is the surprising involvement of both *Rhizobium* and the legume in the production of leghemoglobin; the plant contains the genetic information for the globin while the rhizobia make the heme portion (*42*). This distribution may be a deterrent to the extension of the *Rhizobium* symbiosis to cereals, and the protection of nitrogenase from oxygen must be one of the major considerations in the extension of biological nitrogen fixation to crops where it does not occur naturally.

What is the biological cost to the organism of nitrogen fixation in view of the molecular studies that have revealed the system's inefficiency in energy use? Would it be advantageous to provide fertilizer nitrogen and enable the plant to divert the energy utilized for nitrogen fixation to the production of additional dry matter? A limited number of experiments with legumes have compared the cost of utilizing fixed nitrogen as nitrate with the cost of fixing nitrogen (*43*). In all cases, no difference was found; in the most recent measurements, 5.9 milligrams of carbon was used in the nodule per milligram of nitrogen fixed as opposed to 6.2 mg of carbon used in the root per milligram of nitrogen (applied as nitrate) reduced.

Our biochemical knowledge of the energy requirements for reduction, incorporation into an organic acid, and transportation does not enable a rigorous theoretical comparison of the costs. However, one can calculate the theoretical costs for the reduction of nitrogen to ammonia and NO_3^- to NH_3. In the case of reducing N_2 to $2NH_3$, the calculated energy equivalent is about 24 ATP molecules (9 ATP molecules being equivalent for three pairs of electrons used for reduction and 15 ATP molecules for the nitrogenase reaction based on 4 ATP molecules for two electrons and an 80 percent efficiency in coupling electrons to nitrogen); in the case of reducing $2NO_3^-$ to $2NH_3$, the total energy equivalent is about 24 ATP molecules (24 ATP molecules being equivalent for eight pairs of electrons). These calculations also suggest that there is no difference in energy costs. A corollary of these theoretical calculations is the ratio of 4 : 1 for the minimum amount of carbohydrate consumed to the amount of nitrogen fixed.

The incorporation of ammonia to produce an organonitrogen compound is not a part of the nitrogen-fixing system but is important to the operation of nitrogenase because failure to remove ammonia would lead to repression. In free-living, nitrogen-fixing bacteria and the *Rhizobium* form in soybean nodules (*44*), glutamine synthetase forms glutamine from ammonia, ATP, and glutamate, while glutamate synthetase forms two molecules of glutamate from glutamine, α-ketoglutarate, and reduced nicotinamide adenine dinucleotide. The advantage of this sequence of reactions is the relatively low K_m of glutamine synthetase for ammonia, which thereby facilitates the maintenance of a low concentration of ammonia. The occurrence of this system in other nitrogen-fixing legumes has not been established. Further transformations are necessary in legumes since asparagine (*45*) is the major form of nitrogen transported from the nodule to the aerial part of the plant. These transformations have not been described.

Laboratory and field studies are producing new understanding of the *Rhizobium*-legume symbiosis. The establishment in vitro of a nitrogen-fixing *Rhizobium*-legume symbiosis by means of cell culture techniques provided a new approach for the study of factors that control the infection and development of the symbiosis (*46*). Nitrogen-fixing activity in vitro was about 1 percent of that in the natural nodule based on measurements of both C_2H_2 reduction and ^{15}N-enrichment following incubation with $^{15}N_2$. Electron micrographs revealed rhizobia within the nonperipheral cells of the callus in an arrangement similar to that in the natural system. Subsequent studies with cowpea *Rhizobium* utilizing a solid rather than a liquid medium revealed less specificity in the system in vitro than in the nodule of the whole plant: this *Rhizobium* strain, when cultured with soybean plant cells, produced a nitrogen-fixing

soybean callus but does not, however, infect intact soybean plants (*47*).

Evidence for an even greater promiscuity of cowpea *Rhizobium* has come from studies of nitrogen-fixing nodules on a nonleguminous plant, *Trema canabina*, observed in the field. A cowpea *Rhizobium* was obtained from the nodules of this plant and was used to establish nitrogen-fixing nodules on both the normal leguminous host and the abnormal nonleguminous host (*15*). One may ask what other unusual naturally occurring nitrogen-fixing systems are waiting to be discovered. Most recently, nitrogen fixation has been expressed by cowpea *Rhizobium* externally associated with either leguminous or nonleguminous plant cells in culture (*16*). The activity is low but appears to be real and lasts for about 24 hours after removal of the plant cells. These observations suggest that a diffusible factor common to both legumes and nonlegumes will cause rhizobia to become free-living diazotrophs and improve the possibility of our extending the rhizobia symbiosis to nonleguminous crop plants such as the cereal grains. Understanding the molecular nature of specificity between plant and bacterium may be fundamental to such an extension. Lectins have been proposed as a possible basis for specificity in the *Rhizobium*-legume root nodule infection based on the observed specificity in the binding of soybean *Rhizobium* (*48*). Successful extension of the rhizobial symbiosis to cereals would be one of the most attractive alternative technologies.

Photosynthesis and Nitrogen Fixation

Rhizobium-based symbiosis and the associative symbiosis in tropical grasses appear to offer the greatest opportunity for increased input of nitrogen to grain legumes and cereal grains. Additional measurements continue to show that free-living heterotrophic organisms have a minor role in nitrogen fixation in the soil; however, a plant-algal association, *Azollo-Anabaena*, is reported to fix 60 to 140 kg of nitrogen per hectare annually (*49*).

The acetylene-ethylene assay, with its capacity for up to 200 measurements per day in the field, has enabled investigators to determine the time course of nitrogen fixation in field-grown soybeans from seedling to senescence (Fig. 6) (*50*). About 10 percent of the nitrogen fixed by field-grown soybeans occurs during vegetative growth, while about 90 percent occurs during reproductive growth—apparently an ideal timing of input to need. The nitrate utilization system in the aerial part of the plant complements nitrogen fixation in the root nodules since maximum nitrate reductase activity precedes that of nitrogenase activity. Nitrate reductase activity also is found in the nodule in high amounts and it has recently been suggested that this system may provide an important input of reduced nitrogen; however, further measurements are needed to evaluate this proposal (*51*). The nitrogen-fixation time courses revealed two major limitations of the nitrogen-fixation system. Only about 75 kg of nitrogen per hectare are biologically fixed during the complete growth cycle, and this accounts for only 25 percent of the nitrogen in the mature plant, forcing the surprising conclusion that the majority of the nitrogen required for the U.S. soybean crop comes from fixed nitrogen in the soil. The time course of nitrogen fixation also shows a loss of the exponential phase of development of the nitrogen-fixation system during the period of rapid reproductive growth, suggesting a further limitation in biological nitrogen fixation.

Both of these limitations appear to be of plant origin and to be specifically related to a less than optimum supply of photosynthate to the nodule. The products of photosynthesis support the growth of the nodules and provide ATP, reductant, and the carbon skeleton for the removal of fixed nitrogen. The large flux of carbon through the nodule has been measured in nitrogen-fixing pea plants during vegetative growth in the laboratory. For every 100 units of carbon that were fixed by photosynthesis, 32 units moved to the nodule where 12 units were lost as CO_2, 6 units were utilized for nodule growth, and 15 units were transported back to the aerial portion of the plant (*43*). Several factors that decrease the amount of photosynthate available to the nodule have been demonstrated to decrease nitrogen fixation, for example, decreased light intensity from night and shading; decreased source size by partial defoliation, high planting density, and lodging; increased demand of competitive sinks during late seed development; and cessation of translocation to nodule by girdling. Other factors that increase the amount of photosynthate available to the nodule have been demonstrated to increase nitrogen fixation, for example, increased light intensity from day and supplemental light; increased source size by grafting additional foliage and low planting density; decreased demand of competitive sinks by pod removal; and increased rate of photosynthesis by CO_2-enrichment of the foliar canopy (*52*, *53*).

The most dramatic demonstration that photosynthate is a major limiting factor for nitrogen fixation in field-grown soybeans was obtained from a threefold CO_2 enrichment of the soybean canopy during the period of reproductive growth (Fig. 6). The amount of nitrogen fixed was increased from 75 to 425 kg per hectare as a result of CO_2 enrichment, while the amount of nitrogen obtained from the soil was decreased from 220 to 85 kg per hectare, showing that the CO_2-enriched soybeans fixed 85 percent of their nitrogen requirement, whereas the unenriched plants fixed only 25 percent. In addition, the total nitrogen input was increased from 295 to 510 kg per hectare, representing the first example of a major increase in input of nitrogen to a grain legume. This major effect of CO_2 enrichment has been attributed to an increased net production of photosynthate made possible by the decrease in photorespiration brought about by the elevated CO_2 to O_2 ratio.

The increase in nitrogen fixation by the CO_2-enriched plants is a product of three effects. There is an almost immediate doubling in the nitrogen-fixing activity per mass of nodules, suggesting that there is excess nitrogenase in the nodule but that its activity is limited because of an inadequate supply of photosynthate. As a result of CO_2 enrichment the number of nodules approximately doubles. In addition, there is a delay in the loss of the exponential phase of nitrogen fixation, which thereby extends the period of nitrogen fixation to meet the needs of the later stages of seed development.

A limited amount of similar information has been obtained for peanuts and peas, and there is a need for more information of this type on the other grain legumes so that we can establish the limiting factors of biological nitrogen fixation in these different crops. For the results to be relevant to the field production of crops, the measurements must be made on plants grown under natural field conditions. It is clear in the case of the soybean that, in order to achieve a major increase in nitrogen fixation, attention must be focused on

practical approaches that will lead to improvement in the amounts of photosynthate available to the nodule. The same approach may also be found to be the key to other grain legumes since they are also photosynthetically inefficient. The distribution of associative symbioses described in the next section suggests that the availability of photosynthate may also be a key factor in these systems. It may be suggested that improved photosynthate production by cereals such as wheat and rice may be a prerequisite for the useful extension of any biological nitrogen-fixing system to these crops.

Associate Symbioses in Tropical Grasses

In the early 1960's a nitrogen-fixing associative symbiosis was observed in the rhizosphere (the root zone) between a tropical grass, *Paspalum notatum*, and a free-living, nitrogen-fixing bacterium, *Azotobacter paspalum* (*54*). The bacteria were located underneath a mucilagenous sheath on root surfaces of the plant. This observation has been extended to several additional photosynthetically efficient tropical grasses including sugarcane and maize (*55*). Associations of nitrogen-fixing bacteria with rice roots are also suggested. Most recently an associative symbiosis between *Digitaria decumbens* and *Spirillum lipoferrum* has been identified (*56*). In this association the bacteria infect the root cortex cells beneath the epidermis. The amount of nitrogen fixed by these associations is suggested to be as much as 100 kg per hectare per year, but data obtained from measurements in situ over a substantial period of time are not yet available. Most of the measurements on these systems have been made after the roots of plants have been incubated under reduced pO_2 for extended periods of time so that the reported measurements may have little relationship to the nitrogen-fixing activity in situ. Attempts to reconstitute a nitrogen-fixing associative symbiosis have in general not been successful, although a recent preliminary report suggests successful use of cultures of *Spirillum* as an inoculum for forage grasses (*57*).

These new discoveries of naturally occurring nitrogen-fixing associations are receiving increased attention. Attempts must be made to measure in situ the amounts of nitrogen fixed as a result of these associations, to search for additional associations, and to domesticate these associations to our major cereal grains. Another approach is the development of forced associative symbioses involving a diazotroph mutant with desirable nitrogen-fixing properties and a dependency on the cereal grain for a vital factor (*58*). Success of these systems depends on the intimacy of the partners. The energy contribution of the higher plant must be readily available without loss to the microsymbiont, while the fixed nitrogen must also be taken up effectively by the higher plant.

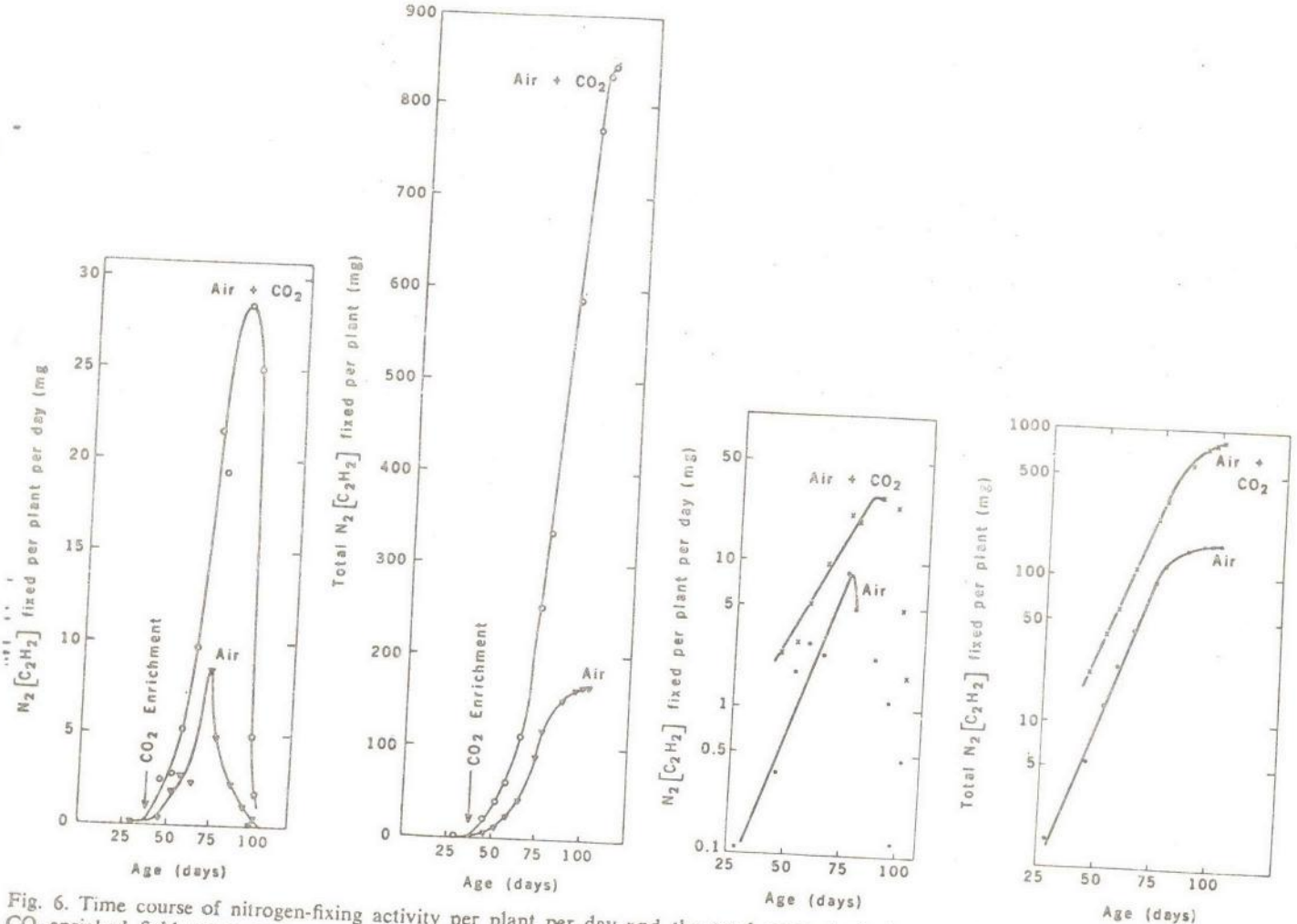

Fig. 6. Time course of nitrogen-fixing activity per plant per day and the total amount of nitrogen fixed per plant for control and CO_2-enriched field-grown soybeans. The CO_2-enrichment occurred from 40 days of age to maturity during the day and produced a CO_2 concentration of 800 to 1000 parts per million in the canopy. [From Hardy and Havelka (*52*), courtesy of Cambridge University Press, England]

The Application of Genetics to Nitrogen Fixation

At present, many investigators are focusing on the control, transfer, and mapping of the genetic information for nitrogenase. Ammonia is well established as a repressor of nitrogenase synthesis, while no evidence has been obtained to suggest that nitrogen is required as an inducer (*59*). Recently, glutamine synthetase acting as a positive control agent has been proposed as the more immediate regulator of nitrogenase synthesis (*60*). Evidence to support this proposal includes mutants with constitutive glutamine synthetase that synthesize nitrogenase in the presence of NH_4^+; mutants that are unable to produce glutamine synthetase and that are also unable to synthesize nitrogenase; simultaneous restoration of glutamine synthetase and nitrogenase activities; and nitrogenase synthesis in the presence of excess NH_4^+ and methionine sulfone and sulfoxime (glutamate analogs and inhibitors of glutamine and glutamate synthetase). The studies providing this evidence were conducted with *Klebsiella pneumoniae*, and empirical approaches have yielded *Azotobacter* mutants that produce nitrogenase in the presence of ammonia. A rhizobial mutant that is constitutive in nitrogenase is being sought and could be useful in eliminating the inhibitory effect of fixed nitrogen on legume symbionts; however, nitrate, which is not a repressor of nitrogenase synthesis, is usually a more potent inhibitor of nitrogen fixation than NH_4^+, suggesting additional complexities in this system. Mutants constitutive for nitrogen fixation may find more utility in the associative symbioses such as those with tropical grasses or in animal rumens. Mutants that excrete ammonia and are constitutive for nitrogenase have been prepared but the high ratio of the amount of carbohydrate consumed to the amount of nitrogen fixed probably eliminates the utility of these organisms as microbiological fertilizer nitrogen factories (*61*).

Another area that might have a major impact on nitrogen input to crops concerns the possibility of moving the genetic information for the control and structure of nitrogenase, that is, the nitrogen operon, from plant species that fix nitrogen to others that do not. Already this operon has been transferred by transduction or conjugation in heterotrophic bacteria and blue-green algae, and in one case a new strain of *E. coli* that can fix nitrogen has been produced (*62*). The possible transfer of a plasmid containing *nif*, or nitrogen-fixing, genes from *Rhizobium* to *Klebsiella aerogenes*, which does not naturally fix nitrogen, has been reported. These experiments have been used to locate the *nif* gene near the *his* and *shi* genes. Transfer of the nitrogen operon to legume or cereal plants is another possible approach for increasing nitrogen input to crops. There are reports of the transfer of the lactose and galactose operons from *E. coli* to higher plants. Plasmids containing the nitrogen operon could be introduced into protoplasts of the desired crop. These protoplasts would be grown in culture and redifferentiated to produce mature plants with the genetic information carried with the seed (Fig. 7). Several laboratories are working on this possibility. This approach might provide the most ideal solution with respect to the production of alternative technologies for nitrogen fixation but is perhaps the most speculative.

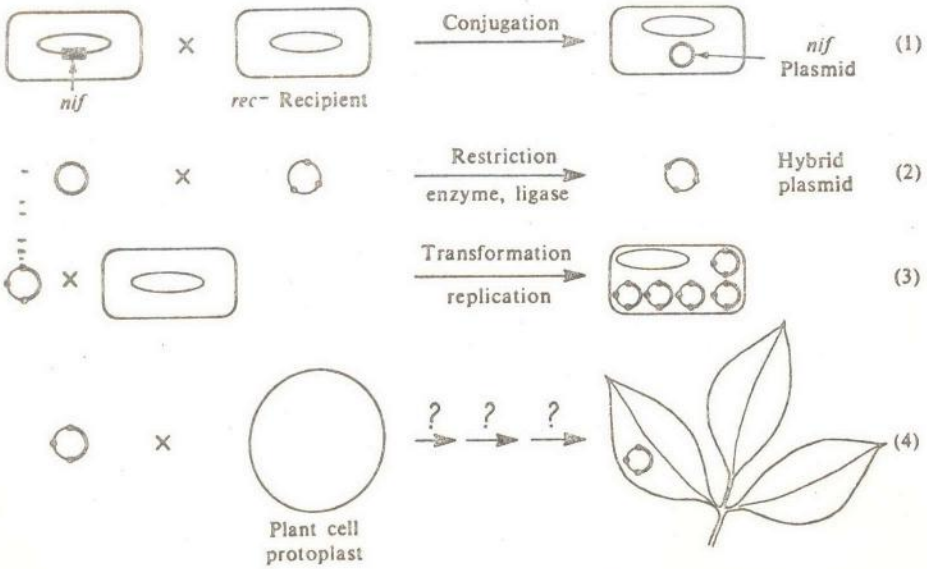

Fig. 7. Hypothetical steps in the production and transfer of plasmids containing *nif* genes to higher plants. [From Shanmugam and Valentine (*7*)]

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