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Dates: 12/07/1972 - 12/29/1972

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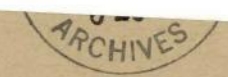
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Development Policy
McNamara file Dec. 1972

Folder 3

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VPD - Senior Adviser - McNamara File - December 1972 - Folder 3



2640

OFFICE MEMORANDUM

TO: Mr. Robert S. McNamara

DATE: December 29, 1972

FROM: Ernest Stern *ES*

818/3/4

SUBJECT: Brazil Livestock Project

1/2 To Mr. Stern

Ernest should not be Program Review

advise you, as this

Banker of me as to whether the project programs for major countries are appropriate "structural" & distributional aspects. Such "advice" need not come only at CPP meetings.

ES



You asked me to review the transcript on the Brazil livestock loan and to assess the arguments. I read the transcript quickly since there was a long waiting list of reviewers, and I have not gone back to the loan documents. On balance, it appeared to me that the points made by the ED's were well founded. The technical justification for focusing again on large farms sounds most unconvincing - but was, of course, the only thing that could be said at that point. After many months of project preparation most every person responsible for a project will become convinced of its rationale and importance. That sincerely held belief is not evidence, however, that a quite different approach could not have been taken earlier.

12/19

The fact is that it is always easier to focus on infrastructure, financial intermediaries and large industry and agriculture. The more units that are involved in a loan/credit, the more complex the assessment and the more difficult the transfer of technology - but not necessarily the higher the productivity. Normal tendencies, plus a heavy workload, plus a desire to achieve growing lending programs inevitably imply a tendency to choose the easy project over the complex. There are counterpressures, but the allure of the established dims only slowly.

The lesson of all this is of course not that we should focus all of our operations on the low-end poor. It does suggest the need for much greater sensitivity, early in the process, to distributional aspects even of projects which are not aimed at the poor. Our loans will always make some difference, and we will never lack for a rationale. The real question is where do we want to put the tradeoffs - is a marginal increase in an already exceptional export performance worth extensive subsidies to the rich. More often the answer should be "no".

EStern/lm

cc to Mr. Hag on 1/8.

OFFICE MEMORANDUM

TO: Mr. Robert S. McNamara

DATE: December 21, 1972

FROM: Ernest Stern *ES*

818/3/3

SUBJECT: Public Works Program

Please be prepared in the form we discussed + I'll send to the Board upon my return.

*BRD / 11/22
WBG 818
ARCHIVE*

I reported on the status of our discussion with Harvard University in my memorandum of October 4, 1972. We have now (after some unexpected delays) received the draft proposal (attached) which you will find of interest. The proposal poses the right policy questions, involves a number of outstanding people and goes to considerable lengths to involve LDC research institutes. I would welcome your comments on the issues to be reviewed.

I expect to discuss this with the Research Committee next week so that we can discuss any necessary changes with Harvard and get work started in the first week of January.

Attachment

EStern/lm



Proposal to

The International Bank for Reconstruction and Development

from the

Development Advisory Service
Center for International Affairs
Harvard University

for a study of

Rural and Urban Public Works Programs in
Developing Countries

Prepared by
John W. Thomas
December, 1972

PROPOSAL FOR A STUDY OF RURAL AND URBAN PUBLIC WORKS PROGRAMS

This proposal is for a comparative study of public works programs in developing nations. Its objective is to analyze the degree to which these programs meet the goals of creating employment and make a contribution to economic growth and other aspects of national development. It will also seek to identify the factors that are crucial to the success of rural and urban public works programs operating in diverse situations in different countries.

The study will examine six to eight specific public works programs representative of the variety of circumstances in which public works programs can be implemented. The work will be done in collaboration with research institutions in the countries being studied. Each institute will collect data and prepare the basic report on its country on the basis of a common research design. A two man research team at Harvard University will work out this research design in consultation with the research institutes and the World Bank, and prepare the final report based on the individual country studies. In addition, a few specialists will be asked to contribute to the study in areas where they have particularly relevant knowledge.

This proposal is organized as follows:

Statement of the Problem

Objectives of the Study

Part I Country Studies: A Preliminary Outline

Part II Evaluation of International Experience
with Public Works

Part III Special Studies of Related Issues

Attachment A Participants in the Research Program

Attachment B Schedule for the Study

Attachment C Budget for the Study

Statement of the Problem

In the 1950's and much of the 1960's economic growth was a primary objective of most developing countries. In recent years there has been a growing recognition that the process of economic development must be more than maximizing national income. Attention must also be paid to how that income is distributed. Poverty can remain a serious problem even in nations experiencing rapid growth, for large portions of the population of many developing countries remain outside the sectors of the economy which are growing. The urban unemployed, the rural landless, or the marginal subsistence farmer are only the most obvious categories of people bypassed by the benefits of growth in low income countries.

As a result, attention has increasingly been focused on ways to deal with persistent poverty in all nations. One obvious way of raising the incomes of the poorer strata of society is to provide employment opportunities for those without jobs and with minimal skills and training. The need for more employment is clear in the statistics of almost every developing nation. Unemployment ranges anywhere from 5% to 20%.^{1/} Creating new employment opportunities is difficult; populations and labor forces expand almost as rapidly

^{1/}David Turnham, The Employment Problem in Less Developed Countries - A Review of Evidence, Organisation For Economic Co-Operation and Development, Paris, 1971.

as many economies and the unemployed in the low income groups are those with the least marketable skills. Furthermore, the creation of new jobs diverts resources from other uses and raises the possibility that such diversion might be less productive and yield less overall growth than if it were not to occur. Yet, the need for additional employment is obvious and priority must be given to creating new jobs if poverty is to be relieved.

Many nations recognize the unemployment problem. Some have taken specific action to deal with it. One step taken by a few nations is to create public works programs which mobilize unskilled, unemployed workers to carry out low cost, labor intensive technically simple development projects. In this way it is hoped that jobs can be created more rapidly than is possible by relying simply on more labor absorption through economic expansion.

If public works programs provide both important additional employment benefits (although presumably only in the short to medium term) and needed physical facilities, at a reasonable cost, that represent a net increase in total output, they would appear to provide an important policy instrument for many developing nations. There are, however, critics of public works programs who claim that the productivity of such programs is so low as to be more in the nature of welfare, that they tend to promote corruption and they become a budgetary drain that slows growth and new job creation over the longer term. These and other questions have not been fully examined.

There is as yet no conclusive evidence on whether or

under what circumstances public works programs fulfill their anticipated objectives, nor on possible trade-offs among the objectives. Employment creating public works programs have been undertaken in only a few countries. The few studies so far carried out have focused on individual countries and have provided mixed and conflicting evidence. For example, one study of East Pakistan's Works Program views it as generally effective in creating employment and productive physical facilities, although subject to increasing political misuse over time.^{2/} A second study concludes that the program was vitiated by the Government's attempts to use it to build political support and control.^{3/} Studies of Morocco's public works program have reached mixed conclusions, with the most comprehensive tending to be favorable,^{4/} while the forthcoming OECD study of public works focusing on Tunisia is reported to be generally critical.^{5/} Past country analyses have focused on differing objectives, proceed from non-comparable

^{2/}John W. Thomas, "Rural Public Works in East Pakistan," in W. P. Falcon & G. F. Papanek (eds.) Development Policy II - The Pakistan Experience, Cambridge, Harvard University Press, 1971.

^{3/}Rahman Sobhan, Basic Democracies, Works Programme and Rural Development in East Pakistan, University of Dacca, 1968.

^{4/}R. Andriamaranjara, Labor Mobilization: The Moroccan Experience, Discussion Paper #15, Center for Research on Economic Development, University of Michigan, 1971

^{5/}F. Kahnert and others, Rural Works Programmes, Food Aid and Employment, OECD, Paris, forthcoming 1973.

analytic frameworks and offer conflicting evidence of the contribution of public works programs.

Objectives of the Study

The present state of knowledge about the performance of public works programs provides insufficient basis for future planning. Therefore, this study proposes to compare the experience of six to eight countries which have undertaken public works programs. The purpose of the study is not primarily to evaluate existing programs but to reach some conclusions on the basis of comparative study of the factors which affect the performance in terms of employment, growth and other appropriate objectives and the results that can be expected from such programs under varying conditions.

The country studies provide the opportunity to examine programs which have operated in a variety of circumstances. Some of these varying conditions might be whether the program is dealing with large scale continuous unemployment or with problems that are seasonal or frictional. The basic physical conditions and state of development of the country will influence the kinds of physical facilities a public works program will construct and their productivity. The social and political structure may determine who receives the benefits. In areas of highly concentrated land holdings, tenants will probably be made to donate their labor to build a road that serves the land they cultivate, but which will primarily increase the income of the landlord.

Another element in understanding why public works programs perform as they do is the varying objectives of governmental leaders initiating and implementing public works programs. The goals toward which they are working must be understood before the results can be fully evaluated. Some objectives of public works programs are clearly stated. Others may remain deliberately unarticulated. Part of the task of the study will be to identify all the objectives, both explicit and implicit and the way in which they, and the conflicts among them, affect performance.

There are a great number of variables that can affect the performance of public works programs. A crucial part of the study will be to identify these variables and how, why and when they operate. It is possible at this stage to suggest only some of the most obvious. Who controls the allocation of funds, who makes decisions as to projects undertaken, and who hires the labor are important factors which will influence the results of the program. Whether jobs are created in urban or rural areas will affect the pattern of population movements as well as wage rates and the impact on sectors of the economy. If programs are operated under a centralized administrative system, the results may be different than if the system is decentralized. The degree to which the program is politicized will have an important relation to results. The ultimate productivity of a public works program may depend on establishing

linkages to other sectors or programs. If works promote agricultural production, if they are part of larger water development programs or create or promote small scale industrial production, if they establish an alternative source of rural power which can create pressures for reform, public works are far more important than if such linkages do not exist. A crucial part of the study will be to identify factors and the manner in which they operate, so as to be able to assess their effect on the performance of public works programs.

The complexities of identifying varying circumstances, factors and objectives of public works programs that affect their performance have been suggested. The actual impact of the program on the country's economy, development plans and political system will be obtained from the country studies. A preliminary outline for these studies follows.

Part I Country Studies: A Preliminary Outline

Eight public works programs in countries of Asia, Africa and Latin America have been identified for detailed study. These have been selected because they represent attempts to apply the basic public works concept in widely differing ways and with very diverse objectives.

The Works Program in Bangladesh - A large scale rural and urban program which has had very different objectives and performance under changing political leadership.

The Kabupaten Development Program in Indonesia - A large scale rural program which has both economic and political objectives, and is administered by a decentralized system.

The Crash Scheme for Rural Employment in two districts of India

An important new program linked to a number of other reform and production programs which will attempt to alleviate a serious problem of rural unemployment.

Various public works projects in Korea A series of projects not combined in a comprehensive program aimed at producing specific rural facilities by the most economic means.

Promotion Nationale in Morocco A large nationwide program, centrally administered for both urban and rural areas.

The Workers Brigades and the National Service Corps in Ghana Highly political programs which emphasized mobilization of the unemployed and political recruitment and gave lower priority to economic factors.

Neighborhood Public Works Projects of Accion Communal in Columbia A primarily urban program which had heavy overtones of community development. A primary objective was improving urban facilities being overburdened by rapid incoming migration.

Provincial Program of Public Works in Tucuman Province, Argentina A small program administered in one Province only for a short period to meet a serious short-term unemployment problem.

Each country study would be organized along the following lines so as to produce a series of studies and data that are comparable:

A. The Environment for Public Works Programs

1. What was the magnitude of unemployment or under-employment?
2. What was the nature of unemployment? Was it specific to particular seasons, locations? Was the incidence higher?

among certain groups, educational, occupational, ethnic, linguistic, etc?

3. What were the prospects for employment creation in other sectors of the economy over time?
4. What was the state of physical infrastructure, and what were the needs in the public sector that could be fulfilled by programs utilizing labor intensive technology.
5. What political pressures or commitments represented a prerequisite for undertaking such programs?

B. Description of the Program

1. What are the real financial and social costs?
2. What work has been completed?
3. How many man years of employment have been created annually?
4. Who administers the program? How is it financed?
5. What is the location of the work?

C. The Goals of Public Works Programs

1. What objectives did political leaders and program administrators set for the public works program? What priorities were given to employment, creation of physical facilities, political mobilization or other factors in the program?
2. Has the program specifically attempted to redistribute income by allocating funds to the least developed areas of the country?
3. What have been the size and scope of public works programs?
 - a) When was it started and what have been the annual allocations?
 - b) What work has been done? What were the unit costs, and how do they compare with similar jobs done by other means?
4. How were public works financed? What was the mix of domestic and foreign resources? How dependent was the program on external assistance?

5. What role did foreign aid and aid agencies play in the establishment of the program, in formulating its objectives and in influencing its operations.

D. Organization and Technology

1. What was the organizational structure of the program?
 - a) At the national level
 - b) At the local level
 - c) Why and how was this form of organization chosen?
2. Where were and by whom were basic allocation and project selection decisions made?
3. On what terms were workers employed: piece rates, daily wage or salary?
4. Were professional contractors used?
5. What is the annual timing and programming of public works?
6. What technologies were used for different types of activity?
 - a) What was the capital, labor ratio in the program?
 - b) Could the mix have been more labor intensive, if so why wasn't it?
 - c) Did the need for labor intensity represent a constraint?
 - d) What was done to develop or adapt technology to fit conditions of the country?
7. How were the operation and maintenance of public facilities managed?
8. What provisions were made to insure technical standards and quality control?

E. Effects of Public Works on Employment

1. How many were employed for what time periods?
 - a) What skills were utilized and what proportion of the workers were skilled?
2. What were the wage rates in absolute terms and compared to other occupations?

3. How does the organization or the decision-making structure affect the distribution of local power?

H. Longer Term Impact of Public Works

1. For what length of time will public works employment be necessary? Are there specific plans to create jobs to make public works unnecessary?
2. What is the government's capacity to bear the continuing financial cost of the program? Is continuing investment justified as part of the development program?

Part II Evaluation of International Experience with Public Works

The first stage would be completed with the preparation of a description and analysis of individual country programs. The second stage will be an analysis of the country studies to evaluate the general applicability of public works programs for promoting employment and development, and to identify those variables that are crucial in determining the effects of public works programs. Although this stage will depend on the findings of stage one, the emphasis in this section would be on a deeper analysis of the elements of success or failure of public works programs. The comparative information will make it possible to examine the performance of public works programs in a variety of different situations, and with varying objectives, to understand how and under what circumstances they provide a useful instrument of development policy.

In the broadest terms, Part II of the study should enable us to reach some conclusions on the following issues:

1. Are public works programs an effective means of

dealing with unemployment and underemployment? Do they raise incomes among the poorest strata of society? If so, are they short run or are they more sustained?

2. Can labor intensive public works be sufficiently productive so as to justify, in terms of real economic opportunity costs, levels of expenditure necessary to have a significant impact on unemployment? Are they more than just a technique for redistributing income?

3. Is the way public works programs are organized a critical factor in their success or failure? What are the alternatives?

4. Can public works programs be an interim measure to deal with specific problems or do they create a constituency and situation which forces them to be extended indefinitely?

5. What range of objectives do governments have when undertaking such programs? Why, despite the prevalence of unemployment and the frequent availability of foreign resources to support such programs have they not been more common?

6. Are there clear political effects on the individual or the government of large scale employment by the government?

7. How do public works programs, their size, location and activities affect other elements of the national development program?

8. What role should external assistance agencies play in encouraging and financing such programs?

9. What generalizations can be made on the basis of comparative study about whether, under what circumstances and how public works should be undertaken in a particular country?

With this expansion of the knowledge of the effects of public works programs, it will be possible to plan and utilize them with much more knowledge of how they will affect the area in which they are being undertaken. It will also be possible to judge more accurately, how effective they will be in helping solve the problem of poverty among the poorest strata of societies.

Part III Special Studies of Related Issues

The final section of the analysis of public works programs will consist of a series of special studies of issues directly related to the impact which these programs have. This section suggests the types of issues which might be dealt with in this way. Each of these studies will be carried out by someone with particular knowledge of the issue concerned.

A. Methods for Evaluating Proposed Public Works Programs

If public works programs prove to be an effective means of creating employment, it will be important to find ways of adapting standard project analysis techniques to this type of program. An economist with particular skills in project analysis techniques will be obtained to work on this subject and develop a basis for evaluating potential public works programs.

B. Effects of Public Works Programs on Rural-Urban Migration

The public works study will provide data on the creation of new urban and rural employment opportunities. It will be important to understand the potential impact of these. Considerable work is being done on the general type of rural-urban migration and the nature and effects of urban unemployment. It will be important to link the accumulated knowledge about public works to other related studies to provide a more precise analysis of the impact of new rural or urban jobs on the flow of people into urban areas.

C. The Impact of Public Works Programs on the Urban Environment

Rapid urbanization has created major problems in maintaining a habitable urban environment. Many facilities needed for this purpose, housing, water and sanitation systems could be created on a labor intensive basis. This study would examine future needs of this type and

explore how public works programs might contribute to meeting these needs.

D. Public Works and Rural Development

The success of public works programs will be closely related to other programs of rural development and to the distribution of power in rural society and vice versa. It is important to have a model for understanding these inter-relationships. This will require the work of someone who has looked closely at this type of inter-relationship in a number of countries.

E. Public Works and Agriculture

Like rural development the links between agricultural production and public works are close. Under this study someone will examine the elements of mutual reinforcement between these two activities to isolate the critical variables and in the way they affect each other. This work should also develop a systematic means of analyzing this relationship.

F. Political Linkages and Effects of Public Works

Most governments have strong political motives in establishing public works programs. They have frequently attempted to utilize the organization of public works to mobilize political support. This can have both good and bad effects. On the other end, the effects of participation in national development programs can affect how citizens view their government and their own capacity to change their situation. These factors will have to be thoroughly explore.

G. Public Works in China and Cuba

Both China and Cuba have implemented public works on a labor

intensive basis. Although it is not possible to study these efforts directly, there may be important lessons that can be learned from their experience. Therefore, it is proposed to obtain what information is available second-hand on the way labor intensive programs have been operated in these countries.

H. A Model of an Economy with a Public Works Program

To fully understand the impact of a public works program on the economy of any country, a model is particularly useful. By designing and utilizing such a model it should be possible to gain a better understanding of how public works affected the countries studied and might affect countries initiating such programs in the future.

The present expectation is that these studies would not be integrated into the rest of the study but stand separately as an expansion of the country studies and the analysis based on them.

Participants in the Research Program

The research will be carried out by three distinct groups. The primary research group at Harvard which will bear overall responsibility for the program would consist of John W. Thomas who will take responsibility for directing the program. Search is under-way for a second full-time researcher. The person being sought will be a first class economist with personal experience with problems in developing countries. He (or she) will be an economist with specialization in one or more of the following fields: agriculture, rural development, labor, unemployment, human resources, and project analysis. Names of persons under consideration can be provided informally since we are still in the stage of checking, obtaining references and considering alternatives and have made no commitments to individuals or even discussed their participation directly with some of those under consideration.

These two researchers will prepare the research design, assist the collaborating research institutions in initiating and conducting their studies if needed, and will spend sufficient time in each country to be familiar with the public works program there. Their principal responsibility however, will be to analyze and compare the country studies and prepare the final report.

The country studies which will provide the basic data for this project are to be carried out by research institutions in the countries being studied. We hope to establish relationships with the following institutions in the countries to be studied:

Korea: Korean Development Institute

Indonesia: Leknas: National Economic and Social Research Council

Bangladesh: Bangladesh Institute of Development Economics

India: The National Planning Commission

Morocco: Research Division, Planning Secretariat

Ghana: Institute of Statistical, Social and Economic Research, University of Ghana

Columbia: Economic Development Research Center, Los Andes University

Argentina: Economics Department, Tucuman University

In addition to the two principle investigators, a number of consultants or research associates will be obtained to assist with particular parts of the study or to work on the special topics listed under Part III of this research proposal. The following list is neither final nor exclusive. It represents people who might be available to contribute some time to the study.

Walter P. Falcon - Professor of Economics, Director,
Food Research Institute
Stanford University

Carl H. Gotsch Development Advisory Service
Harvard University

Richard Hook Tutor, Government Department
Harvard University
Former Vice-President, Girard Trust Co.

Millard Long Development Advisory Service
Harvard University

Arthur MacEwan Assistant Professor of Economics
Harvard University

David Morawetz Lecturer, Dept. of Economics
Hebrew University, Jerusalem

Dwight Perkins Professor of Economics
Harvard University

Peter Rogers

Associate Professor of City Planning
Center for Population Studies
Harvard University

Harold Thomas

Professor of Mechanical Engineering and of
Center for Population Studies
Harvard University

SCHEDULE FOR THE PUBLIC WORKS PROGRAM STUDY

January 1, 1973	Start contract.
January-February	Drafting of details of research design and outline of country studies.
March	Conference to discuss research design.
March-April	Visits to country research institutes and beginning of country studies.
June-August	Visits to countries studied by Cambridge research staff.
September	Conference for presentation and discussion of draft country reports.
October	Preliminary analysis of country data. Visits to countries being studied by Cambridge staff if necessary.
November	Final country reports submitted.
November 1973-April 1974	Editing of country reports. Analysis of data and drafting of report.
April	Draft study submitted to IBRD.
April-August	Preparation of final report.
August, 1974	Final study submitted to IBRD.

December 6, 1972

PUBLIC WORKS STUDY

Draft Budget

January 1, 1973 - August 31, 1974

I. <u>Senior Researchers</u>			
A. Salaries			\$ 55,585
B. Retirement and Benefits			10,560
C. Secretarial Services			12,000
D. Research Assistance			7,000
E. Social Security & Insurance			2,660
F. Travel			
1. Air fares	12,960		
2. Local Travel (in country)	1,600		
3. Maintenance Allowance	<u>9,960</u>		24,520
G. Other Dollar Costs			
1. Books	300		
2. Xerox	1,000		
3. Telephone & Telegraph	1,500		
4. Supplies	2,000		
5. Manuscript typing	<u>100</u>		<u>4,900</u>
Sub-total, Senior Researchers:			\$117,225
II. <u>Consultants</u>			
A. Senior Research Consultants			\$ 15,000
B. Research Associates			<u>15,000</u>
Sub-total, Consultants:			30,000
III. <u>Affiliated Foreign Research Institutes</u>			
A. Senior Researchers			\$ 57,600
B. Field Research Assistants			46,400
C. Other Costs			<u>56,000</u>
Sub-total, Foreign Research Institutes:			160,000

-2-

PUBLIC WORKS STUDYDraft Budget
(cont.)IV. Conferences

A. Three-day Conference for U.S. based Experts			
1. Air fares		\$ 1,345	
2. Per diems		<u>1,275</u>	
Sub-total, Conference U.S. based Experts:		\$ 2,620	
B. Three-day Conference for Foreign Researchers		\$ 8,145	
1. Air fares		2,880	
2. Per diems		200	
3. Conference facilities		<u>150</u>	
4. Secretarial Services			
Sub-total, Conference Foreign Researchers:		\$ 11,375	
Sub-total, Conferences:			\$ 13,995

V. Computer Time

3,000

VI. Management and Support

A. IIE (5% x \$195,545)		\$ 9,795	
B. DAS (5% x \$325,220)		16,210	
C. Harvard* (23% x \$32,170 + \$ 4,050)		8,330	
(27% x \$96,505 + \$12,160)		<u>29,340</u>	
Sub-total, Management and Support:			<u>63,675</u>
GRAND TOTAL:			\$387,895

* Note: Harvard overhead rate will increase on July 1, 1973 from 23% to 27%.

*12/22 to Mr. Stern
mck
Thank you
end*

OFFICE MEMORANDUM

TO: Mr. Robert S. McNamara

DATE: December 18, 1972

FROM: Ernest Stern *ES*.

818 13/12

SUBJECT:



The attached documents are not the ones I was thinking of when I mentioned that a succinct DAC statement on the problems of least developed countries existed. I have written to Ed Martin to try and locate it. However, these more detailed studies will give you some flavor of the information collected on the least developed, by sector and subsector, and the suggestions for action under discussion. Annex I (Agriculture), Annex V (Socio-Economic Features) and Annex VI (Secondary Education) may be of particular interest.

If they could, I would like to see them

Attachments

EStern/lm

12/14

McK 1-121 To Mr. Stern
for info + job
Snow

THE FORD FOUNDATION
Inter-Office Memorandum

TO: Mr. Robert McNamara

DATE: December 15, 1972

FROM: Eugene S. Staples *ES*

COPY TO: ID Chron
ID China
ESS Chron
IR-6 (GF: China)

SUBJECT: The Chinese Experience in Agriculture

Bob--

I know you are interested in good thinking on the Chinese experience in rural development. Attached is a paper which has come to us from Dwight Perkins, a Harvard economist with a specialist interest in China, which deals with some of the questions you were asking about the Chinese experience during the recent Trustees' meeting up here.

I am sorry the copy is so poor, but this is the way it came to us.

ESS:ep
Attachment

The Choice of Technology in Chinese Agriculture

by

Dwight H. Perkins

818/3/11



Technology, whether in agriculture or another sector, is not chosen in vacuum according to some clear criteria of what is "best" or "most modern". If it is to serve a useful purpose, the technology selected must be suitable to the nation's economic goals and factor endowment (relative amounts of land, labor, and capital). Thus in analyzing why and with what degree of success China has opted for particular agricultural technologies, one must begin with a notion of the nature of China's agricultural problem.

China has pursued with varying degrees of vigor four basic economic goals in the agricultural sector: increases in output, a rise in the marketed portion of that output, the absorption of underemployed rural labor into useful work, and a more equitable distribution of income and consumption. The first and third goals have a direct bearing on the choice of technology. The second and fourth have an important indirect effect on that choice but to discuss these in a short paper would take us too far afield.

Raising farm output is imperative both to keep up with China's apparently still rapidly growing population¹ and to allow for increases in per capita food consumption. So far the few figures we have available suggest that China has been able to meet the first requirement, but has made little headway on the second (see Table 1). Farm output has grown at a pace of just over two percent per annum or just enough to keep up with a population increase rate pushed up by dramatic improvements in the 1950's in public health and in the equitable distribution of basic foods.

Just to keep pace with this rise in the number of people has necessitated prodigious efforts on the part of all concerned. To begin with, there has been

Table 1

Indicators of Agricultural Performance

	a			b	
	1952	1957	1970	annual rate of increase 1957/1952	1970/1957 ^c
Gross Value of Farm Output (billions of yuan) (1952 prices)	48.39	60.35 53.70	--- (?) 72.00	4.4%	(?) 2.3%
Grain Output (billion metric tons)	154.4	185	240	3.7%	2.0%
Population (billions)	575	647	800+ ^d	2.4%	(?)

a. The figures for 1952 and 1957 are all officially released data. The 1952 figures are widely believed to be underestimates resulting from the incomplete coverage of early statistical reporting services (see Kang Chao, Agricultural Production in Communist China [Madison: University of Wisconsin Press, 1970] Chapter 8). If the 1952 figures are underestimates, then the 1952-1957 growth rates should be reduced somewhat although they would still be above the 1957-1970 rate.

b. The 1970 gross value and grain output figures are from Edgar Snow's interviews with Chou En-lai ("The Open Door," The New Republic, May 27, 1971, pp. 20-21). The gross value of output is given as US \$30 billion and the exchange rate as 2.40 yuan to the dollar. Unfortunately we do not know in what year's prices this 1970 gross value output figure was calculated.

c. Because of the possibility that the 1970 gross value of output figure could have been calculated in prices significantly different from those of 1957, this growth rate of 2.3% must be treated with caution (if prices rose after 1957 the growth rate of real output would be lower and vice versa).

d. Snow says that China's population is "approaching 800 million," but it is not clear where he gets this figure. If the 647 million figure is accurate, a population of 800 million in 1970 would imply a growth rate of 1.7% per year which in this writer's opinion is probably too low.

little scope for the extension of the cultivated acreage at reasonable cost. In fact, due to the development of cities, factories, and water control facilities the cultivated acreage actually fell between 1957 and 1958 from 112 million hectares to 103 million hectares and to 102 million hectares in 1965.² Edgar Snow refers to an addition to the cultivated acreage of some 12 million hectares of marginal land over the previous ten year period.³ But it is not clear whether this increase raised total cultivated acreage or offset the effects of land alienated to other purposes. Whichever the case, it is unlikely that China's agricultural problems will be solved by continued efforts in this direction (which is not to say that such efforts are likely to be useless, only marginal). Even such extensions of acreage that do occur will depend heavily on complementary investments to provide an adequate water supply (through the expansion of irrigation facilities, the use of power pumps to raise water onto higher terraces, and the like).

The key to whatever success China will achieve in this sector in the future lies instead with increasing yields. It is also increasing yields that account for most of the rise in output that China has attained over the past decade. The only other possible solution would be an effective birth control program that would eliminate the need for rapidly rising output (substantial reliance on food imports is not practical for a country of China's size). But success in controlling population, even given China's apparent vigorous efforts in this direction, is a long term solution that will probably only take effect over decades. The large proportion of the population already living that is in the younger child-bearing age brackets (or will soon enter them) should ensure a fairly high crude birth rate for some time to come.

Efforts to raise yields with sufficient rapidity in the future will probably depend on a more vigorous pursuit of policies related to the choice

of technology that are much like those pursued during the past decade. Thus the discussion which follows is largely devoted to an analysis of what China has done in the farm sector during the 1960's. It begins with an exploration of Chinese efforts to raise the rate of fertilizer application and to develop and distribute improved seeds. This is followed by an analysis of the degree to which China possesses "surplus labor" in rural areas and the relationship of the amount of this labor, if any, to the use of machinery in Chinese agriculture and to the whole problem of how to provide China's farms with an adequate and timely supply of water. Although the emphasis in the discussion that follows is on the effect of these measures on yields, it should be kept in mind that they also influence the level of employment, an end in itself quite apart from whether the increase in employment raises yields and output.

Better Seeds and More Fertilizer

Enormous publicity has been given during the past several years to the impact that improved seeds have had on grain output in Asia and elsewhere. The new varieties developed by scientists at the Rockefeller financed institutes in Mexico and the Philippines have been given credit for bringing about a "green revolution." Economists have even begun to worry about a second generation of problems caused by this revolution, problems of storage, of income distribution, and of marketing.

Unfortunately available evidence does not allow one to say much about how far any comparable efforts have progressed in China. That such efforts have been made, of course, goes without saying. The problem lies in appraising the degree of their success. We are told, for example, that the grain crop area sown to improved seeds rose from 4.7 percent in 1952 to 55.2 percent in 1957 and 77.5 percent in 1958.⁴ But given the near stagnation in grain production between say 1955 when output was 1.75 million tons and 1963 when it

was 183 million tons⁵ one can probably conclude that the new seeds were only a marginal improvement over their predecessors. Similarly the use of improved seeds for edible oil crops had no apparent effect on output whatsoever. While the use of better oil crop seeds increased from 1.9 percent of the acreage sown to peanuts, rapeseed, and sesame in 1952 to 47.7 percent in 1957, and the acreage sown to these three crops expanded, output of peanuts increased only 11 percent and that of rapeseed and sesame seed actually fell.⁶

The one crop upon which improved seeds do appear to have had a substantial effect in the 1950's is cotton. The best available evidence suggests that the area sown to cotton did not change much between the 1930's and 1952 or 1957. Output, however, appears to have risen from 940 thousand tons to 1,640 thousand tons or 74 percent.⁷ The introduction of improved American varieties of cotton had begun in the late 19th century and had made some progress against the older varieties in the 1920's and 1930's. In 1952 when government extension efforts were just getting underway roughly half of the cotton sown acreage was already in improved varieties and that figure rose to 94 percent in 1957.⁸ Yields rose commensurately from roughly 23 catties per mou in the 1930's to 31 catties in 1952 and 38 catties in 1957.⁹ Better seeds were not the whole story, but it is likely that they were a good part of it.

Data available for the 1960's on this subject is, of course, considerably skimpier than even that which we have for the 1950's. We do know that there were 1,700 state seed farms in operation at the end of 1964, but these farms only produced 1 to 2 percent of the country's seed requirements.¹⁰ We also know that in the late 1960's the Chinese began introducing a new strain of rice with a small stalk, few leaves, high production, and which rarely collapsed prematurely, i.e. a description that sounds much like the strains developed by the International Rice Research Institute in the Philippines.¹¹ There is also

a bit of evidence that the Chinese may have actually experimented with some varieties developed by IRRI, but that is as far as our knowledge extends. It is far from clear that the IRRI varieties, developed as they were for tropical climes, will prove to be suitable further north. Similarly the Mexican wheat varieties are mainly for spring wheat while most Chinese wheat is winter wheat except in the northwest.

If the improved seeds developed outside China turn out to be inappropriate for Chinese conditions, there is little reason to doubt that China can discover its own improved varieties. It doesn't take a miracle to develop "miracle" rice and wheat. Japan, Taiwan, and the Philippines, on China's periphery have all managed to do so. The only question is whether Chinese efforts have already met with success or whether that is a step that will be taken in the future.

Improved seeds are commonly effective in raising yields only when combined with large amounts of fertilizer. In fact one of the principal purposes of new seeds is to make possible the application of chemical fertilizers. Whether because of the introduction of new varieties or not, there is little doubt that there has been a dramatic increase in China's use of chemical fertilizers in the 1960's. The expansion in the domestic production and import of this class of commodities has been the clearest single indication of the shift in Chinese investment priorities after the rural crisis of 1959-1961 from machinery and steel to greater emphasis on agricultural support industries.

In the 1950's chemical fertilizer production remained at a very low level. Instead a great effort was made to ensure that after collectivization peasants continued to make effective use of organic fertilizers. Hogs were given as much attention for the fertilizer that they produced as for their effect on the supply of pork.¹² But it soon became apparent that one could not increase the number of hogs and draft animals unless one could feed them and that in turn required more grain.

Figures for the production and import of chemical fertilizer are presented in Table 2. Because these figures are presented in terms of gross weight rather than the more usual (and meaningful) practice of amount of nutrient equivalent, they are difficult to interpret. Much of this output, for example, is known to come from small scale plants constructed during the last several years. But is the nutrient equivalent of fertilizer produced in these commune enterprises the same as that in large scale modern plants or is it much less? We simply don't know. Whatever the case, however, it is clear that both domestic production and imports of chemical fertilizer have increased very rapidly throughout the 1960's.

When one turns to the impact of this expanded volume of available fertilizer on crop yields a number of additional questions arise. Depending on one's assumptions about the nutrient equivalent of the fertilizer supplied, each sown hectare in China was allocated in 1970 on the average between 10 and 14 kilograms of nutrient equivalent.¹³ In practice, of course, distribution was very uneven with areas with an adequate supply of water (mainly the rice growing regions) and certain cash crops getting the lion's share while other regions received little or nothing. Thus the rate of application may have reached 30 or 40 kilograms per sown hectare in these more favored regions.

What was the yield response to this level of fertilizer use? Most of the data from experimental plots in China together with some estimates of yield response elsewhere would suggest that yields of grain rose 3 or more kilograms for every kilogram of fertilizer (gross weight) or 15 kilograms per kilogram of nutrient equivalent.¹⁴ A response ratio of 3:1 would imply that fertilizer application had accounted for an increase in grain output of nearly 45 million tons between 1957 and 1970 or roughly 80 percent of the actual increase of 55 million tons.¹⁵ Even if one assumes that there were only 3 million tons of

Table 2

Chemical Fertilizer Production and Exports
(Reconstructed Official Data)

Year	Production	Exports	Total
	(in thousand tons gross weight)		
1952	183	137	325
1957	871	1,313	2,184
1958	1,462	1,797	3,259
1959	1,777	1,500	3,277
1960	1,930	1,134	3,064
1961	1,740	1,172	2,912
1962	2,610	1,318	3,928
1963	3,650	2,050	5,700
1964	5,660	1,200+	6,860+
1965	7,300	2,500	9,800
1966	8,400	3,500	11,900
1967	n.a.	5,120	--
1968	n.a.	6,000	--
1969	n.a.	6,000+	--
1970	14,000	6,000+	20,000+

Sources: Production figures:

1952-1958: Kang Chao, The Rate and Pattern of Industrial Growth in Communist China, pp. 123 and 129. These are officially released figures, but they differ from those in Ten Great Years in that they include ammonium nitrate and phosphorous fertilizer and not just ammonium sulphate.

1959-1964: These are figures supplied by Chinese officials to a Pakistan delegation and reported in Shahid J. Burki, A Study of Chinese Communes, 1965, p. 6.

1965-1966: These are crude estimates based on announced increases of 1.6 million tons in the first half of 1965 over the first half of 1964 and an increase in 1966 of 1.1 million tons of new capacity (for sources see D.H.Perkins, op. cit., p. 75).

1970: Chou En-lai to Edgar Snow, op. cit., p. 20.

Imports: 1952-1966: For sources see D.H.Perkins, op. cit., p. 74.

1967: J.C. Liu, China's Fertilizer Economy, p. 50.

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nutrient equivalent in 1970 and say 70 percent of that was applied to grain (as contrasted to say 80 percent of 400 thousand tons in 1957) a 15:1 response ratio would imply an increase in grain output (other things being equal) of 25 to 30 million tons. It may be that these response ratios are a bit too high given the conditions that currently prevail on Chinese farms. Farmers, for example, must go through a learning process before they can get the most out of their fertilizer supplies and Chinese experience with heavy application of chemical fertilizers is of quite recent origin.¹⁶ Still any reasonable assumption about yield response would not change the one clear conclusion that can be drawn from the above data. That is that a very substantial part of the rise in grain output between 1957 and 1970, certainly over half and perhaps as much as 80 percent was made possible by the increased application of chemical fertilizers.

How much longer can the Chinese continue to raise grain output in this manner? The Japanese currently apply slightly over 300 kilograms of fertilizer per cultivated hectare or over 60 kilograms in terms of nutrient equivalent.¹⁷ A simple projection of these figures onto the situation in China would imply that China could raise its fertilizer application by from four to five times, but such a projection would be highly misleading. The use of large amounts of fertilizer generally is possible only where there is an accompanying supply of water for purposes of irrigation. Most Japanese farmland is in fact planted to rice and is irrigated. Such is not the case in China where only 20 percent of the sown acreage was in rice (in 1957) and only one-third of the cultivated acreage was irrigated (in 1963).¹⁸

It is possible that fertilizer application on irrigated land in China is already getting near to Japanese levels. If all available fertilizer in 1970,

for example, were applied only to this irrigated land, the amount per cultivated hectare would be roughly 80 kilograms (in terms of nutrient) or above the Japanese rate of application.¹⁹ In actual practice fertilizer is not distributed in this manner, but irrigated land in China today may be receiving 40 kilograms per hectare or more. Chou En-lai may have recognized that China was nearing an upper limit on how much fertilizer it could use effectively given the existing technology. He spoke to Edgar Snow of a target of from 30 to 35 million tons to be achieved in 1975 and said that, "Thirty million tons of chemical fertilizer may be more or less sufficient but we need more because not only grain crops but cash crops need fertilizer."²⁰

If 30 to 35 million tons is China's upper limit, what will come after that? Even under favorable assumptions, the additional 10 to 15 million tons will only allow grain output to rise another 30 to 45 million tons or enough to feed an additional population of 150 million (7 to 10 years population growth at present rates) at existing levels of consumption. China will remain on a vicious treadmill with one key difference from the 1960's -- one major way of staying even or pushing ahead, that of raising yields through the application of more fertilizer will be closed.

One solution to this approaching challenge would be to develop new and better seeds that would respond to increased fertilizer applications with even higher yields. As indicated above, we don't really know how much progress China is making in this area. It is clear from the previous discussion, however, that such progress is essential to China's economic future. In addition, there are a number of other alternatives available to Chinese policy makers. Perhaps the most important of these will be the extension of irrigated acreage to encompass a much higher proportion of China's cultivated land. Thus not only raising yields directly, but also making possible a much greater

use of fertilizer on areas that can now take very little. How this can be done and at what cost is the subject of the next section.

Irrigated Land and Underemployed Labor vs. Machinery

The marginal product of rural labor in China is without question very low. The addition of more labor to the task of growing crops on existing land may raise output a bit (by increased hoeing or more double cropping, etc.) but the increase has long since reached the point where it is insufficient to sustain the additional worker. Further there are long periods (during much of the winter in the north, for example) when farm workers have little or nothing to do. It has long been the hope of economists and others that somehow this labor power could be mobilized and put to constructive use creating capital through the building of roads, irrigation facilities, and the like. China, however, is the only country to actually put some of these hopes into practice on a large scale.

Underemployed labor has been used in China for a variety of purposes including reforestation, road building, terracing of land and the like. Most of all, however, it has been used in the construction of water control facilities (irrigation, drainage, etc.). In judging the effectiveness of this source of increased productivity, therefore, it is necessary to look at whether the use of underemployed labor has led to a substantial extension of China's irrigated acreage (and related improvements) in the past or is likely to be the answer to how China is to increase its irrigated land in the future.

The record through 1957 is reasonably clear. By the end of the first-five-year-plan, China had succeeded in raising the nation's irrigated acreage from roughly 21 million hectares to nearly 35 million hectares. In part this increase represented a recovery to pre-war levels (when the figure was about 26

or 27 million hectares) and in part an expansion from the old levels in both the north and the south.²¹ There were also many improvements to existing facilities.

In 1958, however, labor intensive methods were applied on a much grander scale with the intention of achieving a situation in a brief period of time where virtually all of China's acreage would be capable of being irrigated. The total irrigated acreage was reported to have increased between 1957 and 1958 from 35 million hectares to 67 million hectares²² with the bulk of the rise being in the north where the percentage of land irrigated in such provinces as Shantung and Shansi rose from 23% to 70% and 19% to 54% respectively.²³ Even allowing for considerable exaggeration as a result of the dismantling of the statistical reporting service, there is little doubt that there was an enormous outpouring of effort particularly in the north.

But most of that effort went for naught. Beginning in 1959 China suffered through three poor harvests with the north being hit particularly hard. By the time recovery had been achieved in 1962 one no longer heard claims of vast new increases in irrigated acreage. In fact, although the reports are somewhat vague, it appears that the total amount of irrigated land is not much higher than it was in 1957. What went wrong?

The answer appears to be that labor intensive methods by themselves could not bring about the kinds of water control construction required.²⁴ North China's rivers flood frequently carrying with them great quantities of silt. This sediment clogs irrigation facilities almost as soon as they are completed rendering them useless. Irrigation is also made difficult by the fact that land in the north is prone to water logging.

The ultimate answer to this problem is to bring the great rivers of the north (Yellow, Hwai, and Hai) under control in such a way as to eliminate

flooding and to remove some of the sediment which they carry. But this will involve the construction of large modern dams at a great number of locations on the upper reaches of these rivers. Labor corvee's can undoubtedly play some role in this process, but only a modest one when compared to the building of local facilities in the south where workers could continue to live and eat at home, where only rudimentary machinery was required, and when few if any modern materials were used.

Control of the northern rivers, therefore, is likely to prove expensive. One estimate puts the total cost of controlling just the Hwai and Hai Rivers at 12.6 billion yuan,²⁵ and control of the Yellow River would presumably be even more costly. Such sums, however, are not beyond the realm of the possible. Chinese GNP today must be over 200 billion yuan and this investment could be stretched out over a decade or more provided it was begun soon (some parts of a program to control the northern rivers have, of course, been underway or completed for some time). In any case, if extension of the irrigated acreage proves to be the principal or only means for making possible the greater use of chemical fertilizers and hence of raising yields, the Chinese government will have little choice but to push ahead with a scheme to fully control the Yellow River at almost any likely cost.

Labor power in rural China, of course, is not used solely or even mainly to build water control projects. Most is instead used to raise crops and to transport them to the market. Given the enormous number of farm workers in China is there any reason to introduce machinery into Chinese agriculture? The answer is a qualified yes. First of all, there are many kinds of farm machinery which do not in any way involve a reduction in the demand for labor. Better plows and improved hoes, for example, raise the quality of cultivation, but still have to be guided or wielded by men.

Second, there are certain mechanizable tasks that must be carried out during periods of peak labor demand. There is a considerable body of evidence to indicate that during such peak periods there is a shortage and not a surplus of manpower in rural China. In areas where double cropping is possible, for example, farmers must harvest the first crop, reflood the fields, and transplant the second crop all in a short period of time. 26

Several kinds of labor-saving machines are clearly helpful under these circumstances if obtainable at a reasonable price. Power threshers allow the harvest to be gotten into the barn more quickly, power pumps can move great quantities of water to the fields more quickly and efficiently than a man or ox turning a water wheel, and mechanized transplanters can reduce the amount of labor required for that arduous task.

Of these three types of machinery, only power pumps appear to be extensively used in China although there has been some increase in threshers as well. There has also been talk of the use of mechanized transplanters, but if Japanese experience is any guide, these machines tend to be quite expensive and have yet to find much acceptance from farmers even under Japan's labor short conditions. 27 The predominance of power pumps in China's farm mechanization can be seen from 1964 figures which indicate that of a total horsepower of 7 million for all machinery employed in agriculture, pumping equipment accounted for 4 million horsepower or over half. 28

Most of the increased use of power equipment, like that of chemical fertilizer, occurred after the 1959-1961 difficulties and was also part of an apparent recognition that labor intensive methods of raising yields alone were not enough. By 1963 rural consumption of electricity had risen 1600% above the miniscule level of 1957. 29 In the same year the total horsepower of farm machinery had risen from 0.56 million in 1957 to 5.20 million and rose further to 7.00 million, as already mentioned, in 1964 (see Table 3).

Table 3

Power Machinery Utilization
in Chinese Agriculture

Year	Total Equipment (million horsepower)	Pumping Equipment (million horsepower)	Tractors (thousands of standard 15 h.p. units)	(million horsepower)
1957	0.56	--	24.6	.37
1958	0.69	--	45.3	.68
1959	0.90	--	59.0	.89
1960	1.22	--	73.8	1.11
1961	2.23	--	98.1	1.47
1962	3.60	--	100.0	1.50
1963	5.20	--	103.3	1.55
1964	7.00	4.00	123.4	1.85
1965	--	--	135.7	2.04

Sources: S. J. Burki, op. cit., p. 5 and A. Donnithorne, op. cit., p.113.
These figures are all from official Chinese sources (published and unpublished).

An exception to this pattern of changing priorities was the increase in the number of tractors between 1957 and 1960. Tractors appear to account for most or all of the rise in rural mechanical horsepower during the "great leap forward," but play a declining role after 1961 (see Table 3). It is not at all clear to this writer why China felt a need to expand its tractor supply at this time. Many, to be sure, were used on relatively sparsely populated farms, particularly state farms, in the northeast and northwest, but many others were used in heavily settled regions with some 70 percent of all hsien possessing at least one tractor. Tractors do, of course, reduce the amount of manual and animal labor required for plowing, but it seems likely that the cost of producing, maintaining, and fueling a tractor in China is considerably higher than that of feeding an equivalent number of draft animals and the human labor time saved is not worth enough to make up the difference. It may well be that this is the conclusion that the Chinese themselves reached and that this accounts for the slowdown in tractor introduction after 1961.

Whatever the cost advantages or disadvantages of tractors or the pace of adoption of other kinds of machinery, all such efforts really can only supplement more fundamental measures such as better seeds, more fertilizer, and new or improved supplies of water. The principal use of such machinery is to save labor and, except for tasks that consume enormous amounts of labor such as the movement of irrigation water, China can not afford to spend much husbanding such a plentiful resource.

Lessons from China's Experience

Drawing lessons from China's experience with selecting an appropriate technology for raising farm output is not an easy task. First of all, the transfer of agricultural experience from one country to another is always difficult because conditions vary so much even within a single large nation.

The quality of the soil, the climate, the availability of alternative sources of water, and the number of workers per hectare all change fundamentally as one moves from say India through China to Japan. At the beginning of its modern period, Japan, for example, thought it could introduce Western technology into its agriculture as well as industry and American agricultural specialists were brought over for that purpose. But it was soon discovered that American agricultural technology was irrelevant to Japanese conditions except on the northern island of Hokkaido which had some things in common with Wisconsin.

Second, one doesn't have to go to China to discover that grain yields can be raised by an appropriate combination of chemical fertilizer, improved seeds, and a timely and sufficient supply of water. It is possible that China, with its large machine building industry, may succeed in developing and eventually exporting new kinds of machinery particularly appropriate to economies with a highly labor intensive farm technology, but Japan has a large head start in this area with its small hand tractors, power threshers, and the like.

One area where China has forged ahead of all other nations is in the mobilization of rural "surplus" labor for the construction of public works without the use of modern inputs. Even if one puts aside all the problems involved in mobilizing such labor power, the initial inclination is to look on China's experience in this area as a negative example for others. Mobilization of these people has led to only marginal gains in construction at the cost of considerable disruption in other more fundamental activities such as the raising of crops. But such a conclusion might be misleading. China's inability to get large gains from these efforts is in part a result of the fact that such activities had been going on there for over a thousand years so

that there wasn't that much left to be done by the middle of the 20th century. Other countries, India and much of Southeast Asia, for example, have accomplished much less in this area in the past and might well have something to learn from Chinese experience.

Most of what China has to teach the world about how to improve rural conditions, however, lies outside the area of technology. China is one of the few countries that has made a real effort to come to grips with such major issues as how to reduce income disparities between the well-to-do and the poor without harming the incentive to raise output or how to provide rural employment in industry so as to stem the flow of people into the cities where jobs and housing are inadequate. Analysis of these issues, however, is not appropriate to this brief analysis of the economics of Chinese technology.

China may also prove to be an example of either the limits on the ability of mankind to raise food output indefinitely or alternatively to the benefits and problems that accrue to a poor society that succeeds in limiting its population. Chinese agricultural technology is already more sophisticated than that of most of the rest of the developing world and, if developments in new technology do not continue to arrive in the future as rapidly as they have during the past two decades, China may be the first to feel the consequences. Whether such a limit is ever in fact reached may depend in large measure on the degree to which Chinese scientists themselves take the lead in developing appropriate new techniques.

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Footnotes

1. Recent reports from China indicate that China is making a major effort in the area of birth control, but other reports suggest that population continues to grow rapidly.
2. These are all officially released figures. The 1965 figure is from Chung-kuo ch'ing-pien, 1966, No. 9, p. 16 (as reported in King Chao, Agricultural Production in Communist China, p. 305).
3. Edgar Snow, "The Open Door," The New Republic, May 27, 1971, p. 21.
4. State Statistical Bureau, Ten Great Years, p. 131.
5. The former figure is that of the State Statistical Bureau (at the time only 20.6 percent of the land was sown to improved seeds). The latter figure is that given by Chou En-lai to Edgar Snow (see Edwin F. Jones, "The Emerging Pattern of China's Economic Revolution," in an Economic Profile of Mainland China, p. 93).
6. All figures are those released officially and can be found in Ten Great Years, p. 131 and N. R. Chen, Chinese Economic Statistics, pp. 236-237 and 338-339.
7. For the derivation of these estimates see my, Agricultural Development in China, 1968-1978, pp. 261 and 283. The best acreage and yield estimates for the 1930's are those of Richard Krans, "Cotton in China, 1918-1936," (Unpublished doctoral dissertation, Harvard University, 1968) Chapter II.
8. See discussion in Cotton Research Office of the China Agricultural Science Institute, Chung-kuo mien-hua tsai-pai hsueh, (Shanghai: Shanghai Science and Technology Press, 1959) pp. 1-22, 1-23.
9. D. H. Perkins, op.cit., p. 283.
10. From Chinese sources as reported by Audrey Donnithorne, China's Economic System, p. 102.
11. This discussion is based mainly on a study by Dana G. Dalrymple, "Imports and Plantings of High-Yielding Varieties of Wheat and Rice in the Less Developed Nations," Foreign Economic Development Report No. 8, U.S. Department of Agriculture, 1971, pp. 40-41.
12. See discussion on this point in Kenneth R. Walker, Planning in Chinese Agriculture, pp. 43-56.
13. The upper end of this range was obtained by assuming that 20 million plus tons is equivalent to 4 million tons of nutrient and then dividing by 102 million hectares, the figure for cultivated acreage times 1.4 to convert the cultivated acreage to sown acreage. The lower end of the range was obtained by assuming a nutrient equivalent of 3 million tons, or 1.2 million on imports and 1.8 million on domestic output (or under 13% of its gross weight instead of the usual conversion rates of 20+%).

14. These figures can be found in Jung-chao Liu, China's Fertilizer Economy, pp. 109-121 and K. R. Walker, op.cit., p. 49.
15. This figure was calculated by taking the net increase in fertilizer application between 1957 and 1970 (20 - 2 or 18 million tons) assuming 80 percent or 14.4 million tons was applied to grain and finally multiplying by 3.
16. This is a point to which Werner Klatt gives particular emphasis in "A Review of China's Economy in 1970," The Cidpa Quarterly, July-September 1970, p. 108.
17. J. C. Liu, op. cit., p. 93.
18. The 1957 figure is based on data in Ten Great Years, pp. 128-129 and the 1963 irrigated acreage figure is from a Jen-shin jih-pao editorial quoted in China News Analysis, Sept. 3, 1965, p. 1.
19. One-third of 102 million is 33 million hectares. Four million tons of nutrient equivalent is two billion kilograms or 80 plus kilograms per hectare.
20. Edgar Snow, op.cit., p. 20.
21. These figures are taken from my, Agricultural Development in China, 1368-1968, pp. 64 and 67.
22. Ten Great Years, p. 130.
23. These are officially reported figures that along with others can be found in D.H. Perkins, Ibid., p. 67.
24. The discussion that follows is based on D.H. Perkins, Ibid., pp. 68-69 which in turn draws heavily on the work of A.L. Erisman, "Potential Costs of and Benefits from Diverting River Flow for Irrigation in the North China Plain," (Unpublished Doctoral Dissertation, University of Maryland, 1967).
25. A. L. Erisman, op. cit., pp. 66-67.
26. See discussion on this point in K.R. Walker, "Organization for Agricultural Production in China," in Economic Trends in Mainland China.
27. This is based on information gathered on visits to Japan's rice experimental station at Konosu.
28. S. J. Burki, op. cit., p. 47.
29. Peking Review, December 1964, p. . In 1956 (the 1957 figure is not available) less than 80 million kilowatt hours of electricity were used in agriculture or about half of one percent of the total amount of electricity generated (Wo-luo kang-t'ieh, tien-li, nei-tan, chi-chieh, fang-chih, tsao-chih kang-yeh-te chih-hsi, p.).
30. A. Donnithorne, op. cit., pp. 119-120.
31. See discussion on this point in D.H. Perkins, op.cit., pp. 60-70.

OFFICE MEMORANDUM

TO: Mr. Robert S. McNamara

DATE: December 14, 1972

FROM: Ernest Stern *ES*SUBJECT: Professor Edward S. Mason

12/14

Hollis and I had lunch with Ed Mason last week, during which he indicated that effective February next he would no longer be on a regular consulting basis for us. Instead he is prepared to be on an open-ended consulting contract and undertake such assignments for us as fit in with his interest and schedule. The present arrangement under which he comes to Washington regularly for a week at a time is becoming too onerous.

He said he would discuss this with you personally during his next visit but asked us meanwhile to give you advance notice of his intention.

EStern/lm

President has seen

2550

1-111 To Mr. Stern

OFFICE MEMORANDUM

Shank's email - send me 8/4/72

IBRD/IDA
WBG
7/9/72

TO: Mr. Robert S. McNamara

DATE: December 7, 1972

FROM: Ernest Stern *ES*

as soon as we get it out - I will work it out with some card.

Rnew

SUBJECT:

Attached is the ILO report on Kenya you asked for. After you are finished with it, would you please return it. Printed copies are still rare and this is Mr. Burrows' personal copy. We have requested a supply of copies from ILO and will send you a permanent copy as soon as they are received.

Attachment

EStern/lm