AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D. C. 20523

BIBLIOGRAPHIC INPUT SHEET

FOR AID USE ONLY

1. SUBJECT CLASSIFICATION

A. PRIMARY
AGRICULTURE

B. SECONDARY
GENERAL AGRICULTURE

2. TITLE AND SUBTITLE
SMALL FARM AGRICULTURAL DEVELOPMENT PROBLEMS

3. AUTHOR(S)
HUNTLEY H. BIGGS AND RONALD L. TINNERMEIER

4. DOCUMENT DATE	5. NUMBER OF PAGES	6. ARC NUMBER
1974	178 pages	ARC 630.72-B59z

7. REFERENCE ORGANIZATION NAME AND ADDRESS
COLORADO STATE UNIVERSITY
AGRICULTURAL ENGINEERING DEPARTMENT
FORT COLLINS, COLORADO 80521

8. SUPPLEMENTARY NOTES *(Sponsoring Organization, Publishers, Availability)*

9. ABSTRACT

In recent years development specialists have been increasingly concerned with the sector of the population in developing countries which includes small-scale, subsistence farmers. Part of the reason for this heightened interest stems from the realization that past development strategies have failed to distribute the fruits of economic progress to the majority of the population, many of whom are subsistence farmers. Recognizing that the roots of widespread poverty are found in the rural, subsistence sector, development planners are initiating small farm development programs throughout the developing world. However, there are very special problems encountered when attempting to implement a development program for small farmers. The small farm sector is a highly complex socio-economic system necessitating multidisciplinary analysis. The purpose of this book is to bring together a series of articles dealing with various aspects of the small farm sector as expressed by specialists from a number of disciplines: anthropology, animal science, economics, geography, sociology, and water law. It is hoped that these articles will provide insights into the nature of the small farm sector and thereby, to assist in the formulation of small farmer development programs, and ultimately to alleviate widespread poverty.

10. CONTROL NUMBER	11. PRICE OF DOCUMENT
PN-AAA-613	

12. DESCRIPTORS
Anthropology, animal science, economics, geography, sociology, water law

13. PROJECT NUMBER
931-11-120-115

14. CONTRACT NUMBER
AID/csd - 2460

15. TYPE OF DOCUMENT
RESEARCH BOOK

AID 590-1 (4-74)

SMALL FARM AGRICULTURAL DEVELOPMENT PROBLEMS

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Preface

In recent years development specialists have been increasingly concerned with the sector of the population in developing countries which includes small-scale, subsistence farmers. Part of the reason for this heightened interest stems from the realization that past development strategies have failed to distribute the fruits of economic progress to the majority of the population, many of whom are subsistence farmers. Recognizing that the roots of widespread poverty are found in the rural, subsistence sector, development planners are initiating small farm development programs throughout the developing world. However, there are very special problems encountered when attempting to implement a development program for small farmers. The small farm sector is a highly complex socio-economic system necessitating multidisciplinary analysis. The purpose of this book is to bring together a series of articles dealing with various aspects of the small farm sector as expressed by specialists from a number of disciplines: anthropology, animal science, economics, geography, sociology, and water law. It is hoped that these articles will provide insights into the nature of the small farm sector and thereby, to assist in the formulation of small farmer development programs, and ultimately to alleviate widespread poverty.

These articles originated as a series of seminars presented to an interdisciplinary group of faculty and graduate students at Colorado State University during 1973 and 1974. These on-going seminars, chaired by Henry P. Caulfield, were concerned with topics on water resources development and management in developing countries with special emphasis on water delivery and removal systems. The seminars were related to an Institutional Grant from the Agency for International Development to the University under Section 211 (d) of the Foreign Assistance Act. A water delivery and removal system functions within a given social, economic and institutional setting. The small farm sector constitutes a significant part of that setting in the developing countries; consequently its unique characteristics must be understood and appreciated to assure the success of a water resources development program oriented toward rural development. This conviction is shared by the authors of this volume and is the result of their experiences in developing countries.

The first three articles are concerned with some general aspects relating to the small farm sector. These emphasize, from different perspectives, why development planners should pay special attention to this sector of the population. The last six articles are concerned with specific problems associated with formulating and implementing a small farm development program. These articles are based upon the authors' observations and experiences in India, Korea, West Africa, Pakistan, Peru, Mexico, Egypt and Indonesia.

The case for orienting development programs to the small farm sector is made in the first article by Huntley H. Biggs (Economics). He indicates that economic growth has failed to alleviate poverty among the majority of the population in developing countries. The increasing levels of unemployment and worsening maldistribution of income are grim testimonials to this fact. Programs designed to enhance the levels of living for small farmers could assist in alleviating these interrelated problems. The key elements of such programs are the stimulation of rural employment both on and off the farm, and the raising of productivity levels. Successful results will provide a broad base for future development.

In his article, Wyn F. Owen (Economics) stresses the social welfare function which the small farm sector plays in the development process as a key employer of surplus labor and provisioner of subsistence needs. Large commercially oriented farmers are also important in that they provide surpluses of output for domestic food supplies and perhaps, exports. He suggests that many of the farm sizes proposed as a part of agricultural development programs may be of an intermediate size and thus, inefficient in the performance of either the social welfare function or surplus production for commercial purposes. There is a need to view the small farm sector in its own right and to formulate programs which will expand the capacity of the small farms to perform their transitory roles until such time as meaningful employment opportunities are available in the modern sector. Making the subsistence farmer into a commercial farmer should not be the objective of small farmer programs because they may impede the reallocation of resources to the modern sectors in the process of development.

According to Gene C. Wilken (Geography), there is much to be learned from traditional resources management practices being utilized on small farms throughout the developing world. Such

systems are usually low fossil fuel users, absorb relatively large quantities of labor, are dispersed widely over a variety of social and physical environments and thus, should be relatively easy to transfer across cultures. When linked to modern scientific knowledge, these management practices can stimulate employment and raise productivity levels without having to rely upon elaborate institutional arrangements and supplies of non-conventional inputs originating outside the small farm sector. Some of the traditional practices in the management of water, slope, soil, climate and space are described.

The next six articles are concerned with problems of implementing a successful small farmer development program. Despite the apparent economic benefits that may be associated with the adoption of new production technologies, cultural attitudes and institutional considerations may impede adoption and the long term participation by farmers.

Small-scale subsistence farmers are sometimes referred to as peasants. John L. Schultz (Anthropology) indicates that in peasant societies cultural values, outlooks, and institutional arrangements are as important as economic rewards in influencing the decisions of farmers as to whether they should or should not adopt a new production technology. All aspects of peasant societies tend to be functionally integrated so that changes in economic production methods have repercussions, and possibly destabilizing ones, throughout the entire society. Consequently, there is some reticence to accepting production technologies that disturb the status quo. Technical advisers should be fully aware of the roles of values and institutions on individual decision making in order to increase the possibility of new technology adoption.

From his research on Indian villages, Linwood L. Hodgdon (Sociology) concludes that the role of input suppliers in the conveyance of new production technologies can be crucial to the adoption or non-adoption by small-scale farmers. The variables affecting adoption are analyzed at three levels: situational, local, and external. Often the peasant views government credit programs and extension efforts as being inimical to his interests. To overcome these problems in the future, local participation by subsistence farmers in the formulation and administration of programs is essential to their long-run success.

Ronald L. Tinnermeier (Economics) contends that agricultural credit must be combined with technical assistance to raise productivity levels and promote a sound basis for small farm development in the long run. Current credit programs often fail to give adequate attention to the profitability of proposed technologies. Very often risk is a major factor bearing on the adoption decisions of small farmers. The variability of yields, prices, input supplies and services can make participation in new production ventures very risky. Adoption rates can be improved provided the risk associated with the new technologies can be reduced.

Gerald M. Ward (Animal Science) offers an interesting case for the encouragement of livestock production on small farms. Not only would the products enhance human nutrition but more importantly the activities associated with livestock production will upgrade the quality of human resources for participation in industrial development. Basing his thesis on the economic history of the industrialized nations of the West, Ward indicates that livestock production created a disciplined labor force and an entrepreneurial management class, as well as fostered the development of capitalistic institutions. There are very real problems in introducing livestock raising on small farming units; however, the beneficial implications for total development are quite significant. Greater resources should be devoted to this possibility as a part of small farm development programs.

Alternative organizational forms available to water users on small farms are presented by George E. Radosevich (Water Law). A wide array of organizational forms to more efficiently utilize local water resources has evolved over the ages as a result of social interaction. Cooperation has varied from independent action by farmers in small groups to the most complex of local organizations. Three organizational categories are discussed: private commercial and mutual irrigation companies, quasi-private water user associations, and quasi-public irrigation districts. Organizational forms from the United States and Spain are examined in terms of their usefulness for developing countries. In looking at Pakistan, no serious legal impediments regarding the formation of water user organizations are found; however, little exists which explicitly encourages such associations either. A number of benefits to small farmers resulting from forming a water user organization are outlined.

The Puebla Project in Mexico was designed specifically to raise maize yields on rainfed subsistence plots. Huntley H. Biggs (Economics) traces the experiences of this project. The technical problem of devising a new production technology that would substantially raise yields was relatively simple to solve. However, the problem of generating lasting farmer participation has proved to be quite difficult. Several problems limiting future participation are identified and classified as: technical, institutional, and farmer decision making. Planners contemplating small farmer development programs in other countries will benefit from the lessons of the Puebla Project.

Hopefully, the articles in this volume will offer some insights into the significance of the small farm sector in terms of both the human and land resources allocated to subsistence production and the problems associated with devising a suitable program to raise productivity levels on these farms. In the future, an increasing number of water resources programs and projects will be taking place within the setting of small farm agriculture. It is hoped that some of the ideas in these articles will prove helpful to making these programs successful.

Special appreciation is due Henry P. Caulfield for his encouragement in the formulation of the seminar series which led ultimately to this book. The seminar proved to be an excellent forum for presenting and testing the ideas expressed in the articles. Maurice L. Albertson, Director of the 211 (d) Program, also is to be thanked for providing the support and assistance so necessary for making this volume possible.

This edited book was initiated by Huntley H. Biggs while directing the 1973 winter quarter interdisciplinary seminar on small farmer development. He organized the writing effort for the book, its financing, and the technical editing of the individual contributions. Upon taking an overseas assignment in January, 1974, responsibilities for completing the manuscript were assumed by Ronald L. Tinnermeier. His duties included overseeing the typing of the manuscript, final editing of the book, and the publication and promotion of the book.

The typing of the final draft was accomplished under the able supervision of Anne Alexander of the Water Management Projects

Office. Partial financial assistance in the preparation of this volume was provided by the Agency for International Development's 211 (d) Grant to Colorado State University; however, the ideas expressed in the articles are those of the authors only and do not necessarily reflect the views of AID nor the U. S. Government.

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May, 1974

Chapter I
New Perspectives on Development Strategies

Huntley H. Biggs*

The ultimate objective of economic development is to reduce poverty for the majority of the world's population. The reduction in poverty is implied not only by increases in per capita income but also by increases in various social services (e.g., education, medical facilities, transportation, etc.), by greater participation in political processes and by social justice for all. To accomplish these goals, economic growth is increasingly viewed as a necessary but not a sufficient condition. Generating higher levels of annual production of goods and services (economic growth) provides the means for accomplishing these ends but is not an end itself. Without appropriate distributive measures to assure that the benefits of growth are shared by the poorest groups in the society, there is little guarantee that growth will alleviate poverty. In fact, developmentalists are becoming more aware of the fact that the acceleration of output in the short run may actually increase the number of persons classified as economically and socially deprived. Even worse, the absolute standard of living of those in the poorest group may decline.

The process of economic growth demands dramatic changes in the institutional arrangements governing social and economic activities in traditional societies. Status, rights and incomes which were once ascribed to individuals must now be achieved through obedience to the dictates of economic efficiency. As the traditional system of rights and obligations gives way to the criteria of efficiency and productivity, the weak, unskilled, marginal men are uprooted from their traditional occupations and forced to join the ranks of the landless laborer or urban unemployed. On the other hand, those who are well-educated, ambitious, politically influential and economically advantaged will gain the lion's share of the benefits of growth. Inadequate or nonexistent mechanisms for an

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equalitarian distribution of the fruits of growth mean that the differentials in the living standards between income groups and regions will widen considerably during the initial period of dynamic socio-economic change. Unfortunately, this period may last for several decades during which time poverty becomes even more prevalent among the lowest income groups.

GROWTH, EMPLOYMENT AND INCOME DISTRIBUTION

During the First Decade of Development, the 1960's, many developing countries surpassed the 5% annual growth rate target set by the United Nations.[1] These performances exceeded those of the now developed countries during periods when per capita incomes were comparable. However, the feeling is shared by many developmentalists that for most of these countries poverty among the majority has not been alleviated. "In fact, the 'trickle down' theory of development--whereby the poor supposedly benefit from overall economic growth or policies benefiting the rich--is proving utterly inadequate to the needs of the poorer halves of populations in developing countries."[2]

While the feeling is shared widely that growth has not benefited the poorest groups, it is difficult to find empirical measures of this trend. There are a number of reasons as to why such data are not available. The statistical problems in devising and calculating an index of general welfare are quite difficult and to do so demands the use of scarce human resources. Perhaps even more significant is that government officials fear that such statistics in the hands of ambitious politicians or revolutionaries could lead to social and political instability. There are some data which give evidence of the persistence of poverty, notably those on employment and income distribution.

Unemployment and maldistribution of income are interconnected problems attesting to the persistence of poverty in the developing countries. Continuing high birth rates, in the face of sharp declines in mortality rates, have caused the number of entrants into the work force each year to increase sharply since World War II. For the developed countries, the annual growth rate of the labor force has actually dropped from 1.1% to 1% between 1950-65. For the developing countries, the same figure rose from 1.7% to 2.2%.[3] General economic growth and

the expansion in industrial employment have not been sufficient to absorb these increases in the work force. As the volume of workers increases relative to the number of jobs available, the number of unemployed increases which causes wage rates to be depressed. Meanwhile owners of capital, land and other resources in relatively short supply earn high rates of return. The result is that income and wealth are further distributed in favor of the wealthy minority. Thus, it is apparent that a sound developmental strategy must contain measures to reduce population growth and policies to generate higher levels of employment with improved income distribution. A program aimed at the small farm component of the agricultural sector will assist greatly in accomplishing the latter. Let us examine some of the available information on the employment and income distribution problems.

The data available on the levels of open unemployment reveal that rates in excess of 10% are not uncommon. For example, of the 39 statistics on urban and total unemployment reported for Latin America, 25 of these were greater than 10%, and of these, ten were between 15-20%.[4] The unemployment figures for persons in the age category between 15-25 years are typically double those for the total work force. Whether the rates of unemployment are rising or not is an undecided issue. However, even if unemployment rates remain at their current levels, the sharply rising growth in the work force will mean dramatic increases in the absolute number of unemployed persons.

The figures on open unemployment cited above refer to the proportion of the total work force which is out of work but looking for a job. These understate the employment problem if one were to consider also those who are underemployed or who have been unemployed so long that they have ceased to look for a job. One is typically counted as employed if he is holding a job at the time of the survey regardless of the fact that he may work only 1 or 2 days per week, that he may be occupied in a very low productivity job or that he may be unoccupied for long periods of time due to the seasonality in the demand for his skills. Additionally, many unemployed workers are not even counted because they are difficult to locate in urban shantytowns or isolated rural communities.[5] A measure often used to account for the underemployed is the ratio of the number of available but unused labor hours to the total available labor hours. When this

measure is used the magnitude of the unemployment problem increases significantly. Such studies covering a number of countries indicate that the "unemployment equivalent" rates range from 20% to 50%.[6] For Latin America, this criterion reveals that 30.4% or 25.4 million persons were unemployed in 1969.[7] It is the inclusion of underemployed labor which makes the employment problem so intractable.

The seriousness of the employment problem is further emphasized when one calculates the growth rates in national production which will be required to absorb new entrants into the work force and reduce unemployment to acceptable levels. If an income-employment growth coefficient of 3:1 is assumed, an annual rate of growth in national income of about 6.6% would be required to simply absorb the current growth in the work force of 2.2%.[8] Table 1 below indicates the percentage increases in the growth rates that will be required to reduce the unemployment rate to 5% by 1980. For both Africa and South America, this will require a doubling of growth rates over their current levels.

Table 1. Increases Over Current Growth Rates Required to Reduce Unemployment to 5% by 1980. (percent)

	% Increase in Growth Rate
All Developing Countries	36.2
North Africa	97.4
Sub-Sahara Africa	46.3
West Asia	21.1
South Asia	52.6
East Asia	35.1
Middle America	56.8
South America	93.0

Source: Based on Turnham and Jaeger, p. 116 as quoted in Derek T. Healey, "Development Policy: New Thinking About An Interpretation," The Journal of Economic Literature 10 (September 1972): 769.

While growth rates in many countries have accelerated over the past decade, it is unlikely that they can be increased by the amounts suggested above.

Income distribution statistics for developing countries are not easy to find and when they are available are often incomplete. On the basis of available information, it is quite common to find that the lowest 50% of the income earners receive between 15-20% of the total income, while the highest 10% receive between 40-50%. For the developed countries, the lowest 50% receive between 25-35% of the total income.[9] Despite adequate rates of economic growth in many developing countries, the trend in the distribution of income appears to be toward even greater inequality. The experiences of Mexico, Brazil and the Philippines confirm this contention. In the 1960's growth rates in these countries have been between 6-7 percent and average per capita incomes are among the highest in the Third World; however, income distribution in fact has worsened. For example, in Mexico the ratio of income controlled by the top 20% of income recipierts to the bottom 20% was 10:1 in 1950 but grew to 16:1 in 1969. In the Philippines this ratio grew from 12:1 in 1956 to 16:1 in 1965, and for Brazil it grew from 22:1 in 1960 to 25:1 in 1970.[10] The same story is likely to be repeated in other countries where growth has taken place without basic structural-institutional reforms, such as land reform and progressive income taxation, that influence the distribution of income.

It has been argued that income inequality is necessary in the early stages of development in order to generate the savings rates required to support economic growth. The argument is based upon the assumptions that savings propensities are higher among the wealthy than the poor and that savings will find their way into productive investments. Many developmentalists are raising counterarguments which have tended to weaken this thesis.[11] It is contended, for example, that savings and investment rates among low income groups are understated. In addition, the savings of wealthy families often end up in the form of luxury housing, conspicuous consumption or speculative ventures, rather than in productive investments which generate needed goods, jobs and incomes. It may be argued further that the deficiency in productive investments is attributable to narrow markets due in large measure to an unequal distribution of income. Thus, it is recognized that the lack of effective demand is as important

as low savings rates in explaining the slow growth of productive investments by the private sector in developing countries.

SOME POLICY PRESCRIPTIONS

In light of the persistence of widespread poverty, unemployment and maldistribution of income in the developing countries, the question arises as to what type of a development strategy can help to alleviate these problems. Most developmentalists would agree that continued efforts at stimulating economic growth are important. Economic growth can provide both the material means for approaching the poverty problem and the incentive for expanding investment and employment opportunities. However, past experiences indicate that growth stimulating policies must be coupled with strategies which assure that the majority of the population shares in the benefits of that growth. Since policies aimed at income redistribution per se are difficult to implement and administer, these strategies must emphasize the generation of meaningful employment. This means not simply greater sharing of work, but creating more jobs that simultaneously enhance the productive capacity of the economy for future development. Social justice with productive efficiency should be a major objective. Providing more jobs not only assists in achieving a more egalitarian distribution of income, but also encourages the creation of more jobs in itself. It is assumed that wage earners have a high propensity to consume labor-intensive commodities. Thus, with more purchasing power in the hands of wage earners, the greater the derived demand for labor resources to produce these goods consumed by wage earners.

Increased employment possibilities can be promoted through a number of measures. The encouragement of industrial expansion is important provided greater emphasis is given to labor-intensive techniques which are also efficient. Historically, the rates of growth in industrial employment have lagged behind the rates of growth in both industrial output and in the total work force. In many countries employment growth has been about half that of the growth rate in output. For example, between 1950 and 1960, manufacturing output in Brazil grew at a rate of 9.8% while that for employment was only 2.6%. Over the same period of time, the respective rates for output and employment growth in other countries were: Argentina 4.4% and -2.0%,

Chile 5.4% and 1.7%, Colombia 7.6% and 2.5%, Mexico 6.5% and 9.4%, India 6.8% and 3.3%, and Egypt 5.5% and 3.9%.[12] A partial explanation for these differential growth rates is that modern industrial processes are capital-intensive (labor-saving) in nature having been designed in the developed nations to solve their particular economic and technical needs. When transferred to the labor-surplus economies of the developing countries, unemployment problems are not alleviated and may in some cases be aggravated as traditional handicraft industries are eliminated by labor-saving, factory processes. The selection of technologies for transfer from the developed to the developing countries must be done with considerable care to assure that the needs of the latter are met.[13]

Another approach to job creation is to stimulate public works programs in rural and urban areas which utilize unskilled labor and which are important for improving the country's basic infrastructure. For example, housing and general construction projects seem to be well suited to this task. Efforts also should be made to stimulate the production of labor-intensive commodities for export. The success of such efforts depends in large part on the cooperation of the developed countries to reduce tariffs and perhaps extend preferential treatment to labor-intensive commodities that could be produced efficiently in the developing countries, such as textiles, clothing, footwear, and many processed foods.

To encourage the utilization of labor-intensive production techniques, government policies should be aimed at rationalizing factor prices, meaning to make them consistent with prevailing market supply and demand conditions. In the past, market imperfections, often directly attributable to government policy (wage-labor legislation, subsidized interest rates, etc.), have set wage rates above and interest rates below their equilibrium market rates. This encourages entrepreneurs to adopt capital-intensive production techniques. Of course, any viable development strategy must give attention to the problem of population growth. Effective family planning programs could do much to reduce population growth which in turn would slow the rate of growth in the work force. This would help considerably in easing the task of creating meaningful jobs.

THE CASE FOR RURAL DEVELOPMENT

A development strategy, incorporating the elements of growth with more jobs and a more egalitarian distribution of income, should give special attention to the rural sector. Typically, rural per capita incomes are well below the national average, income is very poorly distributed, and underemployment is quite prevalent in the countryside. Concise figures on the magnitude of rural poverty are difficult to find; however a few examples will be sufficient to highlight the problem. According to a recent World Bank study: "About 700-800 million--about one-third of the total population of the developing world (excluding Mainland China)-- are economically deprived rural people."[14] Included in this category are: small farmers, landless laborers, the unemployed and their families. The subsistence farmers provide the food needs for roughly 50% of the world's entire population on 40% of the world's agricultural land. These figures include the developed nations where less than 8% of the population is engaged in agriculture.[15] For any particular developing country, subsistence farmers may support as much as two-thirds of the entire population. Thus, raising incomes for families in this group would contribute substantially to the alleviation of widespread poverty.

The agricultural sector harbors a large portion of the underemployed labor resources in the developing countries. It has been estimated that in Latin America approximately 60% of the total unemployed can be found in the agricultural sector. This suggests that about one-third of the entire agricultural labor force is unemployed in that region.[16] Underemployment in this sector is only partially explained by the seasonal demands of the cropping cycle. Unfortunately, accelerated agricultural output has not contributed and in fact, may have aggravated this problem where farm mechanization has accompanied agricultural growth. For example, in Mexico total agricultural production increased at an annual average rate of 4.6% over the period 1950-65.[17] However, between 1950-60 it is estimated that the number of landless rural laborers increased from 2.3 million to 3.3 million. The rising levels of rural unemployment are reflected in both a decline in per capita man-days worked, and a decline in real incomes among landless laborers.[18] The on-farm employment generating qualities of the new seed-fertilizer technologies characterizing the Green Revolution may be frustrated by

indiscriminate massive mechanization of all phases of the agricultural cycles even where specific labor bottlenecks are not apparent.[19]

Typically, agricultural per capita income is much below the national average. For example, per capita income in Mexican agriculture was about one-third that of the national average, and less than one-half those found in the secondary and tertiary sectors in 1963.[20] Even worse the distribution of income within the agricultural sector is highly skewed. Again, for Mexico in 1963, more than 40% of the agricultural population (8 million people) belonged to the two lowest income groups, but received only 15% of the income generated in agriculture. By contrast the two highest income groups received 14% of the income yet accounted for only 1.4% of the population in agriculture. The per capita income of the highest income group was nearly one hundred times higher than that of the lowest group.[21] The experience in Mexico is no doubt duplicated in many developing countries throughout the world. Because agriculture is the major source of income for a majority of families, programs aimed at achieving greater income equality in agriculture will do much to promote greater equality nationally.

The rapid rural-urban migration in developing countries is additional testimony to the persistence of poverty in the rural areas. The "push" factors of low per capita incomes, inadequate employment opportunities, and limited access to land resources have generated massive outflows of people from the countryside even when the low probability of obtaining a job in the urban setting is fully understood by the migrant. In Latin America internal migration has meant that urban population has been growing at an annual rate of about 5% compared to only 1% for the balance of the country.[22] At this rate the urban population will double in size about every 14 years. Because of the inadequate growth in meaningful job opportunities in the urban areas, many of these migrants end up populating slums or shantytowns. This "marginal population" has been increasing at the alarming rate of 15% per year in Latin America.[23] The overcrowding of cities creates many problems including: housing shortages, traffic congestion, inadequate water supply and disposal systems, transportation difficulties, and deficits in a wide range of social services. The allocation of resources to meet the immediate and growing "urban crisis" is certainly

necessary; however, it imposes a very high opportunity cost on society. The use of resources to approach problems of massive urbanization may necessitate the sacrifice of development projects that would enhance the long-run productive capacity of the total economy. A key objective of any rural development plan must be to discourage the massive outflow of unskilled, ill-prepared workers from the country to the cities.

On the basis of the preceding evidence, the desirability of rural development programs is not likely to evoke much debate. However, a successful rural development program which accomplishes the tripartate goals of output, employment and income must have many complementary components. For example, consideration should be given to the possibility of land reform in some countries. Existing concentrations of land ownership give a minority the social, economic and political power to exploit the majority. Rural public works programs are essential for providing jobs and incomes, and for creating social overhead capital such as: schools, electrical power, potable water, transportation, storage and marketing facilities. The possibility of rural industrialization should be explored. Rural industries to produce agricultural inputs and to process and market outputs can mean more jobs. In this connection, the planning of regional growth centers has been suggested. Not only will this approach help to achieve a more balanced regional development but also will alleviate the population pressures in major cities, particularly capital cities, due to rural-urban migration.

Of course, a successful rural development program must not neglect continued efforts to develop and extend new production technologies to the farmers. In devising the new technologies, researchers must take into consideration the relative availability of the productive factors in the regions where they are to be utilized. In general terms, this means that technologies should be devised which raise the productivity (output per input), of the relatively scarce factor by saving or reducing the use of this factor and/or increasing its output.[24] In regions where land is abundant relative to labor, labor-saving (capital-intensive) technologies are appropriate in raising labor productivity. This implies the mechanization of agriculture which allows one man to cultivate large tracts of land. Contrawise, in densely populated areas, land-saving (labor-intensive) technologies should be

introduced which raise yields (land productivity) and utilize large quantities of the abundant factor, labor. Inattention to these considerations will lead to an inefficiency in the allocation of resources, resulting in unemployment and sacrifices in total production.

Finally, a major focus of any rural development program must be on the small farm cultivator who is producing only enough to support his immediate family at a minimal level. Strategies aimed at raising production levels on subsistence holdings can have many beneficial implications for total development. The major attribute of each program is that they directly attack poverty for a large segment of the developing world's population. Commenting on the problem of growing rural unemployment and the deficiency of income earning opportunities in the countryside, Oris Wells states:

> "This seems to me the most intractable of all the problems of the developing countries. In areas or regions where the problem of hunger is most acute or at least a constant threat, ways and means must be found for increasing the agricultural productivity while at the same time maintaining in rural areas most of the current populations as well as a substantial portion of their annual increase over the years ahead. This leads a considerable number of people to insist that the greatest single problem is that of rural employment, but once again creating jobs by simply spreading work is not a satisfactory solution. Production must also be increased. Whatever solutions are worked out in many of these countries must be built around small farms and rural industries, as these rural populations are already moving to cities at a faster rate than they can be accommodated."[25]

The balance of this paper is devoted to supporting the argument that increased attention must be given to raising productivity levels on small farms. The position offered here is that such

a strategy can do much to promote the key objectives of development: growth, jobs and greater equality in income distribution.

IMPLICATIONS OF SMALL FARM DEVELOPMENT

In most developing countries, there exist two subsectors within agriculture: the output subsector and the employment subsector.[26] The output subsector is characterized by relatively large farming units utilizing modern production techniques for the purpose of raising marketable surpluses for export or domestic consumption. The employment subsector is composed of small farming units whose output is just sufficient to support the immediate family's consumption needs. The latter performs an important social welfare function by absorbing and feeding the surplus rural population until such time as jobs are available in the industrial-urban areas. While planners should not neglect the output subsector, greater assistance and resources should be devoted to raising the productive capacity of the employment subsector. The double-pronged approach to agricultural development may be termed "contrived dualism."[27]

The rural poor consists of landless laborers, the unemployed and subsistence farmers. While the elimination of poverty for each of these groups is desirable, a strategy aimed specifically at the subsistence farmer has a high probability of success because individuals in this group have access to land, are currently engaged in the production process and have management skills. To initiate production among the landless would be extremely time consuming, and costly since either land reform or colonization is implied a priori. Perhaps an equally strong justification for focusing on the subsistence farmer is that he constitutes by far the majority of the rural poor in developing countries.

If one were asked to describe the structure of world agriculture, an accurate response would be that it is characterized by small farms. Referring to Table 2, one can see that about two-thirds of all the agricultural holdings in the world are between one and five hectares. It is striking to note that this group

Table 2

World Distribution of Agricultural Holdings, Total Area, and Total Cropland by Size of Holding (percent)

		Number of Holdings	Total Area	Total Cropland
1	ha and under 2	31.4	1.7	8.7*
2	ha and under 5	34.0	4.1	12.0
5	ha and under 10	15.7	4.2	11.5
10	ha and under 20	8.6	4.4	10.7
20	ha and under 50	5.2	5.8	11.8
50	ha and under 100	2.3	5.8	9.8
100	ha and under 200	1.4	6.7	11.0
200	ha and under 500	0.8	8.7	11.5
500	ha and under 1000	0.3	6.6	5.9
1000	ha and over	0.3	52.0	7.1

* Includes those holdings less than 1 hectare

Source: United Nations, Food and Agriculture Organization, Report on the 1960 World Census of Agriculture: Analysis and International Comparison of Census Results, Vol. 5. (Rome: FAO, 1971): 35.

accounts for only about 6% of the total agricultural area and about 21% of the total cropland. This difference is explained by the intensive crop production on small units to meet food needs compared to the larger units where much of the land is either unusable for crops, held idle or is used for grazing livestock. It is probably accurate to state that the vast majority of the units in the 1-5 hectare range are operating at the subsistence level.[28] These units provide the food needs for the bulk of the world's population. Raising productivity levels on these holdings would have a remarkable impact on global food supplies and contribute to an agricultural reserve which could be drawn down during periods of poor production.

In the past, programs aimed at small farms have been criticized or avoided on the grounds that they attempt to achieve social justice at the expense of productive efficiency. This argument is founded on the assumption that there are economies of size in farming making large farms relatively more efficient in the use of resources. However, there is increasing empirical evidence from both the developed and the developing nations which casts considerable doubt upon the significance of size economies in agriculture. For some years, there has been ample evidence attesting to the inverse relationship between farm size and yield, a measure of land productivity.[29] More recently, evidence has been accumulating which indicates an inverse relationship between farm size and capital productivity.[30] Since land and capital are the relatively scarce factors of production in developing countries, productive techniques and farm sizes which serve to increase the productivities of these factors are consistent with economic efficiency. These results tend to refute the myth that small operating units are inefficient in the use of scarce resources.

The potential benefits of a successful program for small farm development are many. Raising productivity levels on small farms could add significantly to the total availability of agricultural supplies. Since the combined output of the small individual units constitute an important and in some cases dominant position in total production, marginal productivity gains would have a marked impact on the aggregate. The higher productivity levels will permit a portion of the extra output to be marketed through commercial channels. Not only will this add to the family's total income stream but also will assist in integrating these marginal families into the modern society and economy, an important aspect of the modernization process. Because of their dominant numbers and characteristically low per capita income levels, raising incomes among small farmers will help to achieve a more egalitarian distribution of income and alleviate widespread poverty. A more egalitarian distribution of income will widen markets for many consumer goods thereby increasing the effective demand for industrial investment and encouraging industrial employment. Typically, the technologies which can be applied on small farms are labor absorbing. The additional labor requirements on the farm will help to reduce rural underemployment. Finally, by making income earning possibilities more attractive in the countryside, it is hoped that the push factors which have contributed to rural-urban migration will be ameliorated.

SUMMARY AND CONCLUSIONS

The purpose of this paper has been to make the case for focusing increased resources on raising productivity levels on small farms. Until relatively recently, it has been assumed that economic growth would generate the necessary structural changes in the society to assure that all groups share in the benefits of progress. Available evidence indicates that growth may be a necessary but not a sufficient condition for raising the income levels of the poverty stricken masses. Greater attention must be given to distributional aspects of economic growth. The expansion of meaningful job opportunities as an adjunct to growth is an important step toward achieving a more equitable distribution of the fruits of progress. It is implicitly assumed in this paper that the small farm sector is not likely to disappear in response to general economic growth. Since this sector constitutes a large segment of the poor, efforts to raise income levels among this group will do much to alleviate general poverty.

While the sum of benefits accruing to a successful small farm development program are many, there are many difficulties in devising and administering such a program. Some of these problems are discussed elsewhere in this volume. A criticism often heard is that such programs are very costly, requiring heavy expenditures of funds and human resources per farm family. However, if it were possible to evaluate all of the external benefits to the society which a successful program would generate, the rates of returns on such outlays would give them high priority for the use of public funds.

FOOTNOTES

[1]The following article examines the success stories of 32 developing countries having annual growth rates close to or in excess of 5% during the 1960's: Hollis B. Chenery, "Targets for Development," in The Widening Gap: Development in the 1970's, eds.: Barbara Ward, J. D. Runnalls, and Lenore D'Anjou (New York: Columbia University Press, 1971), pp. 27-46.

[2]Robert E. Hunter, James P. Grant and William Rich, "A New Development Strategy? Greater Equity, Faster Growth and Smaller Families," development paper #11 (Washington, D.C.: Overseas Development Council, October 1972), p. 10.

[3]Erik Thorbecke, "Unemployment and Underemployment in the Developing World," in The Widening Gap: Development in the 1970's, eds.: Barbara Ward et al. (New York: Columbia University Press, 1971), pp. 115-116.

[4]David Turnham and Ingelies Jaeger, The Employment Problem in Less Developed Countries (Paris: Organization for Economic Co-Operation and Development, 1971), Table B.1, pp. 134-135.

[5]William C. Thiesenhusen, "Latin America's Employment Problem," Science 171 (5 March 1971): 869.

[6]Thorbecke, "Unemployment and Underemployment," p. 117. It should be pointed out that some experts contend that if one observes the gap between hours worked and hours available for work, the adjustment for underemployment will increase the full time unemployment rate by only 2 or 3 percentage points. See Turnham and Jaeger, The Employment Problem, pp. 58-60.

[7]Derek T. Healey, "Development Policy: New Thinking About an Interpretation," The Journal of Economic Literature 10 (September 1972): 767.

[8]Harry T. Oshima, "Unemployment and Income Growth in the Less Developed Economies: The Asian Case," in Economic Development: Readings in Theory and Practice, eds.: T. Morgan and G. W. Betz (Belmont, Calif.: Wadsworth Publishing Co., Inc., 1970), p. 280.

[9]Healey, "Development Policy," p. 776.

[10]Robert E. Hunter et al., "New Development Strategy?," Annex.

[11]For an early critique of this argument see: Nathan Rosenberg, "Capital Formation in Underdeveloped Countries," American Economic Review 50 (September 1960): 706-715.

[12]Werner Baer and Michel E. A. Herve, "Employment and Industrialization in Developing Countries," Quarterly Journal of Economics (February 1966): 91.

[13]For a good treatment of the characteristics of appropriate technologies for developing countries and the policy guidelines that should be followed in their selection see: Keith Marsden, "Progressive Technologies for Developing Countries," International Labour Review 101 (May 1970): 475-502.

[14]World Bank, Agriculture: Sector Working Paper (Washington, D.C., June 1972), p. 26.

[15]E. J. Wellhausen, "The Urgency of Accelerating Production on Small Farms," in Strategies for Increasing Agricultural Production on Small Holdings, ed.: Delbert T. Myren (Mexico: International Maize and Wheat Improvement Center, 1970), p. 8.

[16]Thorbecke, "Unemployment and Underemployment," p. 117.

[17]U.S. Department of Agricultural , Economic Research Service, Sources of Change in Mexican Agricultural Production, 1940-65, by Reed Hertford, Foreign Agricultural Economic Report No. 73 (Washington, D.C.: Government Printing Office, 1971), p. 11.

[18]Roger D. Hansen, Mexican Economic Development: The Roots of Rapid Growth, (Washington, D.C.: National Planning Association, 1971), p. 73.

[19]For a good treatment of the problems of mechanization and farm employment see: Robert d'A. Shaw, Jobs and Agricultural Development, monograph No. 3, (Washington, D.C.: Overseas Development Council. 1970).

[20]Eduardo Venezian, "Income Distribution and Agricultural Development in Mexico" (paper presented at the Ford Foundation Agricultural Program Seminar, Bogota, November 6-9, 1968), p. 5.

[21]Ibid., p. 23.

[22]T. Paul Schultz, "Demographic Conditions of Economic Development in Latin America," in Latin America: Problems in Economic Development, ed.: Charles T. Nisbet (New York: Free Press, 1969), p. 49.

[23]Thiesenhusen, "Latin America's Employment Problem," p. 870.

[24]The following article offers a discussion of alternative technologies for agricultural development: Huntley H. Biggs, "Alternative Agricultural Technologies for Developing Countries: Output and Employment Considerations," Technos I (July-September, 1972): 27-32.

[25]Oris V. Wells, "International Agricultural Adjustment, 1970-1980," American Journal of Agricultural Economics 53 (December, 1971), p. 791.

[26]The role of these two subsectors in the development process is recounted in: Wyn F. Owen, "The Double Development Squeeze on Agriculture," American Economic Review 56 (March 1966): 43-70 and Two Rural Sectors: Their Characteristics and Roles in the Development Process, Occassional Paper, No. 1 (Bloomington: International Development Research Center, Indiana University, 1971).

[27]The term "contrived dualism" was first coined in the following: William C. Thiesenhusen, "Population Growth and Agricultural Employment in Latin America, with Some U.S. Comparisons," American Journal of Agricultural Economics 51 (November 1969): 735-752. Since that article, the concept as a policy measure has been explored in: Peter Dorner and Herman Felstehausen, "Agrarian Reform and Employment: The Colombian Case," International Labour Review 100 (September 1970): 221-240; Wyn F. Owen, "Structural Planning in Densely Populated Countries: An Introduction with Applications to Indonesia," The Malayan Economic Review 14 (April 1969): 97-114; and Huntley H. Biggs, "Dualism in Mexican Agricultural Development: Irrigation Development and the Puebla Project, CUSUSWASH Technical Report No. 21 (Fort Collins: Colorado State University, June 21, 1972).

[28]In some countries, small landholdings are very commercialized, producing speciality crops for export (e.g., coffee in Colombia, bananas in Ecuador, cacao in Nigeria, rubber in Malaysia). In this discussion, the term small farms is not limited to a description of the physical size of unit, but rather is used to describe farms which are oriented toward subsistence cultivation.

[29]A number of country studies are referred to in: Dorner and Felstehausen, "Agrarian Reform" pp. 230-31. The statistical validity of these studies may be questioned since they usually are based upon simple averages taken from census data. In an article in this volume, Wyn F. Owen hypothesizes that productivity levels on intermediate size farms may be lower than those on farms which are both larger and smaller. Clearly more empirical work on land productivity by farm size is required.

[30]For example see: R. Albert Berry, "Farm Size Distribution, Income Distribution and the Efficiency of Agricultural Production: Colombia," American Economic Review 62 (May 1972): 403-408.

Chapter II
The Significance of Small Farms in Developing Countries

Wyn F. Owen*

I

Most farmers in the world operate very small farms - small patches of land that hardly qualify as more than back yard gardens. The plantation, the collective, the coporate farm, and, indeed, even the large family farm of the type that one finds in the United States' corn and wheat belts, are exceptions rather than the rule, whether viewed in worldwide or in single country perspective. If this were not the case, the world would face much more serious dimensions of economic underdevelopment and inequality than it does today; the majority of human beings would be roaming the world's countryside or the streets of its cities in a generalized state of landlessness, hopelessness, and lawlessness, reminiscent of the social and economic impact of the enclosure movement in the 18th and 19th centuries in England, but on a far more disastrous and universal scale.

There are, however, still grounds for asking whether or not the small farmer is adequately represented and recognized. Without proper perspective on where the small farmer fits into the total economic scene and the overall process of economic development, the chances of misdirecting investments under agricultural development planning are, indeed, very considerable. This applies to almost all types of investment programming, but nowhere more importantly than in the design and management of water resource projects which deal with one of the most critical needs of small farmers.

As a first step, it needs to be recognized that small farms take many varied forms, and the functions they perform in the development process can be quite different depending upon the

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particular classification into which they fall. Most important is the distinction between small farms that qualify for inclusion in a country's commercial farming sector and those that do not. The former are members of the modernized exchange component of the economy to which they belong; the latter essentially are not. And, what is equally important, the chances of the latter ultimately joining the modern exchange economy depends only in part upon their existing or potential farming opportunity.

To develop this basic distinction further, it may be said that the commercial farming sector is in the business of producing the surplus of farm commodities that finds its way to non-farm consumers. Farms that survive in this sector do so (or should do so) on the basis of their capacity to compete with one another in the market place for farm production resources, including land, and in the efficient utilization of these resources for the production of the farm commodities that are demanded by largely non-farm and largely urban consumers. The non-commercial, or subsistence,[1] farming sector, on the other hand, is primarily in the business of directly supporting any rural population in a country that is both surplus to the labor resource requirements of the commercial farming sector and also lacks immediate access to superior income earning opportunities in non-farming activities. Its member households are in the business of producing or contributing to their subsistence, and they should be doing so at minimum cost to society in terms of the land resources that they, by their existence, deny to the commercial farming sector.

A proximate division of the supply of farming land into these two distinct classes of farms is a characteristic feature of all countries. Thus, in the early 1960's, 14% of the farms in India accounted for about 60% of its farm product sales and in so doing, utilized nearly two-thirds of its farm land. However, since Indian agriculture predominately is organized on a family farming basis, this also implies that between 80% and 90% of its farm population subsisted on about one-third of its farm land.[2] Similarly in Colombia, at about the same time, while 36% of its farms produced nearly 80% of its market farm products from about 90% of its land, approximately two-thirds of its farm population were substantially surviving on small farms that utilized less than 10% of its farming land.[3] The universality of the phenomenon is suggested by the fact that, in the mid-1960's less than one-fifth of the farms in the United States produced over two-thirds of all of the farm products marketed, and in

so doing utilized about half of the country's farm land. At the other extreme, 60% of the country's farms accounted for only a little over 15% of all marketed farm products, but essentially supported about 60% of the country's farm population on about 30% of its farming land. [4]

In practice, of course, the distribution of farm land in all countries tends to be less than ideal in terms of the possibility of jointly maximizing economic efficiency in the two farming sectors, in the performance of their quite different, but equally important, roles. At one extreme it is common to find substantial amounts of farming land in management units that are excessively large, relative to any reasonable definition of the prevailing optimum size of commercial farms in any particular farming area of any selected country. These excessively large commercial farms almost always take the form of factory-type farming enterprises which - akin to the industrial factory - are all characterized by a large (wage) labor force directed by a centralized management. Common examples are the plantation, the collective, and in a less monetized form, the latifundia. These various classes of factory-type farms vary considerably in their relative efficiency, as well as in the historical and ideological reasons for their existence in different parts of the world. The record rather clearly suggests, however, that it is only in very exceptional circumstances that any of them can out-compete an efficient family farm - that is, a farm on which the operator and his family supply most of its labor and where this limited labor supply is combined with the maximum amount of land it can exploit with the aid of the most advanced farming techniques and supporting forms of capital that are compatible with the particular resource endowments and stage of development of the country considered. Thus, even in the heartland of American agriculture, and contrary to popular belief - even among economists - efficient family farms, as defined, appear still to be more than holding their own in competition with farms utilizing hired managers and employing larger inputs of labor. A significant proportion of these family farms are returning to their operators and to their other working family members incomes quite comparable with what they could earn in urban industrial employment. [5]

What is true of the United States' commercial farming sector applies equally in other countries, even though efficient family farms do vary greatly in the particular complement of land and capital inputs that are fully exploitable by a family unit of labor.

Thus, a 2,000 acre wheat farm in Colorado and a 2 acre rice farm in Java may be comparable in this respect. In other words, efficient commercial farms may be quite small in size, and certainly in most parts of the world are very small relative to successful family farming enterprises in the United States.

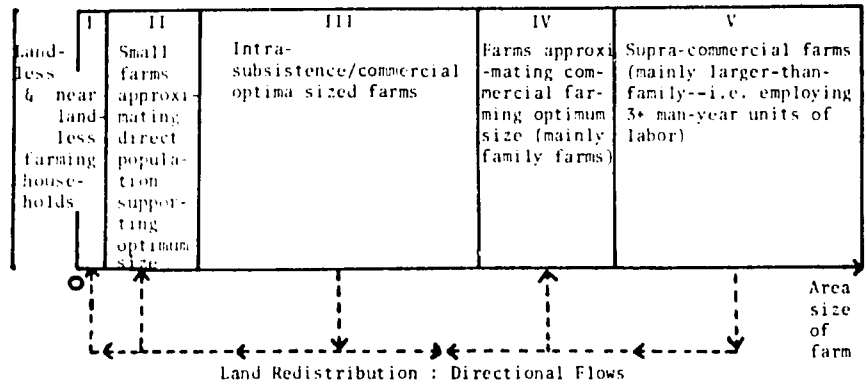
At the same time, successful commercial family farms, even when they are quite small in absolute size, are always relatively large and relatively few in number compared to the sub-commercial category in the same country. The latter is also always far from being homogeneous. At the opposite extreme of the range of farm sizes represented by the supra-commercial farm, it is usual to find a large number of rural households dependent upon agriculture for their economic survival that are either completely landless or that have access to too little land to support their basic subsistence irrespective of how intensively they farm their land. These households, which mainly survive by competing with one another for a share in the limited low wage employment opportunities that exist on other farms, usually are to be counted among the lowest income and social status groups throughout the world.

A step above these are the small farms that have just enough land to provide their dependent households a minimum level of living by the standards of the particular country involved. Finally, there are all the farms that fall between this group and those that have sufficient land to support an efficient family enterprise in the business of commercial farming and at a level of living generally commensurate with that of the modernized sector of the country. There is reason to believe that in most countries large amounts of farm land are trapped in this middle zone of inefficient farm sizes, whether viewed from the point of view of maximum direct support of population (the optimum-sized subsistence farm) or the most efficient production of a market surplus of farm products (the optimum-sized commercial farm).

The conceptual framework presented above is schematically portrayed in Fig. I. The diagram does not carry an absolute area-size scale, since this will vary according to the differing man/land ratios, soil qualities, climatic conditions and stages of development of different countries and regions. The optimum commercial farm may, as has already been suggested, vary from but a few acres to many thousands of acres without necessarily departing from a family farming structure. Similarly, the optimum subsistence farm may

vary from only a fraction of an acre in one set of circumstances to several acres in another.

FIG. I : CLASSIFICATION OF THE FARMS BY SIZE & BLUEPRINT FOR LAND REDISTRIBUTION THROUGH TIME



Land Redistribution : Directional Flows

Whatever the prevailing appropriate area-size scale, the relative distribution of the farm land of any country among the five identified categories of the farm size is of considerable significance. It also follows that the logical pattern for land redistribution in all developing countries, whether under the impetus of revolutionary land reform programs or through simple evolutionary change, is such as to expand the categories of near optimum-sized subsistence and commercial farms (categories II and IV) at the expense of categories III and V. The allocation of land between the first two reflects national priorities with respect to the production of a market surplus of farm products and the provision of a full or part-time rural subsistence opportunity to presently redundant labor vis-a-vis the employment capacity of the developing commercial sectors, both rural and urban.

To subdivide the farming land of any nation into two categories of farms that more or less correspond to the prevailing optimum sizes of farms for subsistence and for commercial farming purposes, is entirely possible; at least in theory. To take the seemingly difficult case of India as an example, it would be theoretically possible to redistribute all of that country's farming land in such a way that 75% of all of its rural households, that are dependent upon agriculture for their livelihood, had an average of 1.5 acres of land each (including a half-acre of irrigated land), while the remaining 25% had

an average of 20 acres of land (including 6 - 7 acres of irrigated land).[6] The latter would certainly not be small as far as efficient commercial family farms go in India[7] and the former would also not be excessively small as a subsistence unit. Indeed such a subsistence farming unit would represent nothing short of a bonanza for the 25% of rural households in India (about 20 million households), that currently are landless.[8] By way of a meaningful comparison, such a unit would be twice as large and contain far more productive soil than the private plots that are held by Russia's collective farm households and which, reportedly, are responsible for at least a third of the entire gross output of Russian agriculture.[9]

II

A number of conclusions follow from the preceding discourse with respect to the nature and significance of small farms, and these lead to important implications for resource development policies and programming. In the first place, it suggests that efficient commercial farms in most circumstances can be expected to be quite small business enterprises, and that water development projects designed to service large scale farms (collectives, cooperative farms, plantations, corporations, and latifundia) will likely be called upon to service objectives additional to, and possibly in conflict with, the promotion of farming efficiency per se. Their principal raison d'etre may well be simply to strengthen existing or aspiring public or private vested interests in the control of the land for political purposes.

A second conclusion is that it is clearly important to identify whether a given development project is designed to serve commercial sector farms or subsistence sector farms. The fact that both may be quite properly categorized as "small farms" can easily confuse the issue. While both may involve "small farms", particularly in the less developed countries, they each belong to two quite different economic worlds. They both compete for the same basic economic resource - farm land - as well as for their fair share in available agricultural investment resources, including those aimed at improving water supplies and water utilization systems.

As has been noted, these basic allocations need to be determined through an appropriate ordering of national priorities with respect to the creation of an adequate agricultural commodity

surplus on the one hand, and the provision of a continuing means of subsistence (or welfare) to any rural population that is redundant to the production of this surplus and yet has no immediate alternative means of survival outside of agriculture. However, when this is determined, the question then becomes; what special considerations should be taken into account in developmental programming within each of these two quite different universes of small farms? The remaining comments are directed to a few of these.

The first thing to note is that, since the commercial sector is likely to involve smaller farming enterprises than many are prone to assume, there is no way to avoid the problem of having to relate to a large number of beneficiaries who operate substantially independently from each other. At the same time, development projects such as those aimed at the improvement of water resources usually depend upon a measure of collective action, and the mechanism whereby this is achieved in a commercial farming setting is likely to be quite critical to its success. If the experiences of the United States in this respect are at all relevant to the needs of developing economies, they will be found to lie in the general area of rural zoning, as expressed through such institutions as Soil and Water Conservancy Districts, and in supporting property theory.[10] The problem is to be solved by looking in these directions rather than in the direction of replacing small (family) commercial farms with large scale (cooperative or corporate) farms, or by unduly extending the life of pre-existing excessively large commercial farms of these general types, through subsidies and other forms of protection.

In this connection, the most important point to emphasize is that commercial farms falling in the optimum size range are by definition profit-making or near profit-making enterprises on the basis of the prevailing market values of resources in the modernized rural and urban components of a given economy. This implies that farmers in this classification are both likely to be relatively well-endowed with business managerial talents and quite capable of deciding upon the economic merits of a given improvement. They equally well will be capable of initiating and carrying out at least a substantial part of the improvements themselves, either individually or collectively, and also may be assumed to be quite capable of paying their fair share of its cost. For this very reason, of course, there is always a strong incentive to focus public-sponsored agricultural development programs upon these very farmers, along

with any larger capital gains-oriented farmers, at the expense of the needs of the subsistence farming sector. While the needs of the efficient commercial and family farmer (and of the still larger farmer) for additional and improved water resources may not be as great as those of the subsistence farmer, neither are the problems of project implementation in their domain. They are, however, likely to be unnecessarily subsidized through a failure to separate them from the larger population of sub-commercial farmers, for whom it can be argued, subsidized developmental programming is both necessary and socially legitimate.

A further aspect of commercial farming sector development follows from the fact that, other things being equal, the optimum size of commercial farms, even as family farms, can normally be expected steadily to increase through time. These farms are also likely to reflect an increasing degree of specialization through time, both in terms of products produced and of the phase of the production process that remains an "on-farm" activity. However, improved irrigation and drainage systems have the effect of slowing down and, in many situations, of completely offsetting both of these trends for substantial periods of time. It may, in other words, render a pre-existing optimum size of commercial farms supra-optimal, and partly because it opens up different and more continuous land use opportunities. These in turn often require sizeable increases in inputs of labor per farm on a year-round basis, if the expanded productive capacity of the land involved is to be fully exploited. Commercial farm sector development programs need always to be evaluated in terms of these likely impacts. Should they justify an immediate substantial downward adjustment in area sizes of operational units to exploit fully the new short-term potential, this automatically becomes an essential component of project implementation, but one that should be accomplished in a manner that will not render its reversal difficult in subsequent years when increasing economies of scale again begin to re-exert themselves within the framework of the new circumstances created by the development project. Clearly, this problem can be substantially skirted if water development projects aimed at the commercial farming sector have their major impact on marginally small commercial farms, which, before the improvement in land production capacity, were suffering from an inadequate land base.

However, a question that deserves most serious consideration is whether or not the commercial farming sector in most developing

countries really warrant the high priority in irrigation and drainage projects that it frequently is accorded, and especially in countries that have a large rural poverty group - including a large landless farm laboring population. An optimum sized commercial farm can be prescribed for any type and location of farming in any country; irrigation and drainage are not necessary conditions to this end. Indeed it is for very good reasons that the majority of most efficient commercial farms in the world inhabit its dry lands and its solely rain-fed humid lands. It is in the latter areas that labor-saving, capital-intensive forms of technology have their greatest relative advantage, and correspondingly, it is in the adoption and exploitation of these technologies that the commercial farmer has gained the greatest rewards to his entrepreneurial talents and probably also the highest levels of satisfaction with his way of life. He is, of course, fully capable of farming irrigated land efficiently - that is, at a comparable profit rate per farm unit[11] - and he can surely produce a greater market surplus per unit of this land for the benefit of the non-farm sector than he can produce from most unirrigated land. But a larger market surplus of farm products does not in all circumstances deserve highest national priority, and, what is equally relevant, the subsistence sector farmer, with his labor intensive methods of cultivation, is not necessarily less productive when it comes to utilizing this type of land.

III

Perspectives on the process of economic development have been improved in recent years by a growing recognition of the world-wide dimensions of rural poverty and underemployment, and of the basic patterns and dimensions of the population flows that are associated with economic growth. The latter involves a long-term trend under which an increasing proportion of the labor resources of any nation is absorbed in non-farm employment, and especially in service activities. Characteristically also, these expanding non-farm employment opportunities have tended to become concentrated in urban areas.[12] However, the structural changes in an economy that this process involves can have bad as well as good effects. As a rule, during any given period of time, more households tend to be either rejected or bypassed by the process[13] than effectively make the transition into either the urban component or the smaller rural component of the expanding modernized sector of a developing

economy. Most of the world's population that has not been caught up in the process of modernization has remained trapped in the rural subsistence sector - the residual heartland of world poverty and underdevelopment.[14] In terms of the total world's population, the inhabitants of this sector both constitute the majority and continue to increase in absolute numbers.[15]

The growing number of rural poor represents an alarming prospect - a seedbed for violent revolutionary movements in many countries.[16] The challenge it represents is also rendered the more difficult to meet because, on the one hand, high birth rates are heavily concentrated and most difficult to reduce in this particular sector, and, on the other hand, because the existing avenues of escape from the sector clearly fall far short of what would be needed to change significantly the total picture. There is simply no way in which the farming land in most countries of the world could be equally divided among all of the rural poor without destroying any semblance of an efficient commercial farming sector upon which the very existence of an urban-industrial sector depends.[17] At the same time, as several recent studies indicate, existing urban-industrial areas fall far short of providing the rate of employment opportunity creation that would be equal to the task of siphoning off a significant portion of the rural poor.[18] There is a growing consensus that the numbers of expectant migrants from the countryside already constitute a serious threat to the very survival of many of the existing urban-industrial centers of the world.[19]

If current trends persist, one may anticipate the continuing concentration of a large proportion of the population of most countries, and of the world as a whole, in rural subsistence sectors, representing an economic refuge-of-last-resort for the poor. Consequently, the allocation of an appropriate proportion of the farming land of almost all countries to servicing the subsistence needs of the households involved deserves high priority in developmental planning. However, this alone is not sufficient. In addition, the subsistence farming sector needs to be viewed as a separate and critical developmental planning environment in its own right. An improvement in the future levels of living of the inhabitants of this sector will be realized in only a very peripheral sense through migration to job opportunities in existing urban-industrial areas or through the conversion of sub-commercial small farms into viable, commercial farms. Rather, it is going to be realized by expanding the existing subsistence farming opportunity, both in terms of the

number of households it serves, and in terms of increasing the productivity of the land it utilizes, and by supplementing this with new non-farm employment opportunities within the reach of the members of these households - that is, within the resource framework of the subsistence sector itself. In other words, the subsistence farming opportunity is to be viewed both as a real and present economic opportunity with a growth potential in its own right, and as a launching pad for a broader and inter-related spectrum of developmental activities. Without the latter dimension, long-run economic progress within this particular sector can have only very limited prospects.

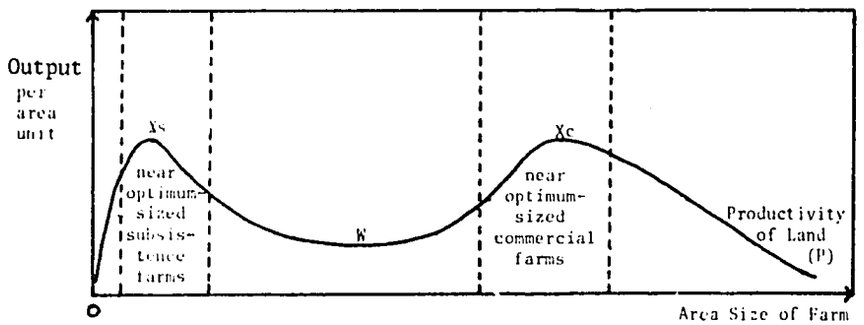
IV

Without losing sight of the critical need for programming additional employment opportunities jointly on both the farming and non-farming frontiers within the rural subsistence sector, let us first examine some of the principal characteristics and potentialities that are inherent in the employment absorptive and productive capacity of its farming component. This, in any event, provides the essential starting point, around which other economic activities need to be generated.

It has been long recognized that petite culture can be exceedingly productive and also, that the "culture of poverty"[20] is nowhere more highly developed than in the realm of subsistence farming.[21] The majority of the world's poor cling to small patches of land for very good and time-honored reasons. With respect to the question of land productivity, there is considerable evidence to suggest that over a significant range of small farm sizes a negative correlation exists between farm size and land productivity - that is, over the range XsW of the productivity function presented in Fig. II.[22] The reason for this phenomenon has been well identified by Georgescu-Roegan as an application of what he referred to as the "feudal formula",[23] and Clifford Geertz has described it in the context of Indonesia as the process of "agricultural involution".[24] From the point of view of economic analysis, this outcome is explained by the application of an entirely different set of decision rules from those that apply in the modernized, exchange-oriented parts of free market economies, with respect to the process of labor absorption in productive work and to the determination of the total labor employment opportunity. In the case of the modernized sectors (both farm

and non-farm), labor is absorbed to the point at which its marginal value product equals the established (modern sector) wage rate. On the other hand, in the traditional-subsistence sector, labor is absorbed well beyond this point through the process of "splitting-the job" and "work sharing" that form part of the traditional rules of subsistence household or village economic life.[25] In contrast to

FIG. II : GENERALIZED FARM SIZE : LAND PRODUCTIVITY FUNCTION



Xs = Max. potential land productivity in subsistence sector with given technology
Xc = " " " " " commercial " " " "

the maximization of product specialization and adoption of labor-saving techniques which typify the modernized, commercial farming sector, maximum employment opportunities in the subsistence sector are sought through the process of maximum diversification of production. This is reflected in such phenomena as: multiple cropping, the exploitation of complementarities between crop and livestock enterprises and between farm production activities per se, and the processing of farm inputs and farm products by the farm household. These dimensions of spatial intensification of productive activity are also supplemented, under subsistence farming conditions, by a widespread application of the forms of task specialization that are compatible with the "splitting-of-the-job," phenomenon. For example, women and children tend to be allocated particular jobs like grain harvesting, in which a high level of dexterity in the use of the hand is required. The economic system, of course, in such circumstances adheres to an application of the so-called communistic principle of "to each according to need; from each according to ability", which is, and always has been, the basic economic organizational rule of subsistence societies.

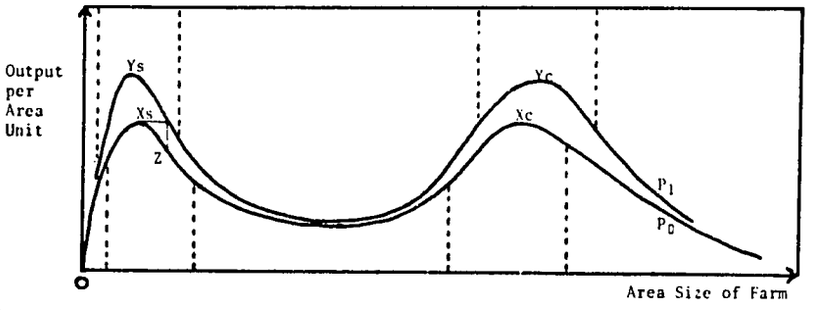
Seen in this light, it is abundantly clear that land and water resource development projects and all forms of land-saving technologies of the type generally associated with the "Green Revolution" can play a highly positive role in the future of subsistence farming. To the extent that these can be extended to the small subsistence sector farmer, the new technologies will have the effect of either reducing the amount of land that is needed to provide all of the rural poor with access to a minimum basic standard of living, or of raising this minimum over time, or both. It is well known that many of the possibilities inherent in the new biological and chemical technological break-throughs of the current agricultural revolution are highly dependent upon adequate irrigation and drainage for their full exploitation. Given the latter, and the labor-intensive techniques that are applicable in the subsistence farming sector, this sector has the potential of realizing levels of land productivity that match or surpass that of the best commercial farms utilizing the same type of land. With this capability, to the extent that there remains a substantial pool of farm labor that is unemployable elsewhere in an economy, it can be argued that the subsistence sector has a higher claim to certain land resources than the commercial farming sector.

However, it is not increased output only that is important to the small subsistence farmer. Of prior importance is the assurance of stability in output through time - whereby he can be insured of continued survival even if this is only at his existing low level of living. Irrigation and drainage are extremely effective means to this end, as also are expanded opportunities for multiple and continuous cropping where they do not risk depletion of the productive capacity of the land. These, too, can be substantially provided for in many circumstances through irrigation and drainage, and especially so if such projects are linked with improved availability of artificial fertilizers and of location-specific crop varieties.

The claim of the subsistence farming sector to land resources should not be evaluated solely in terms of the productivity of its land relative to the productivity of the same land if used for commercial farming. The same applies to evaluating the impact of land development projects; in the subsistence farming sector the land productivity results may not tell the whole story. Much will depend upon where the subsistence farming household has been operating, relative to the generalized farm size-land productivity function applying under the pre-existing resources and technological

framework. Were it operating near point Xs in Fig. II, this would imply that it had reached the point of maximum exploitation of its labor resources under the pre-existing conditions, and at the same time was operating at minimum land cost to society as a whole. The question of how such a household will respond to an improvement in the productive potential of its land, as a result of resource improvements and/or the availability of compatible new techniques, will depend on how it weights a change in its working and living patterns against an increase in commodity production (and consumption). Referring to Fig. III, the impact of resource development

FIG. III : IMPACT OF LAND SAVING TECHNOLOGY



Ys = Max. potential land productivity in subsistence sector following technological change
Yc = " " " " " commercial " " " "

and technological progress may be represented by a rise in the production function from P_0 to P_1. A subsistence household that was operating before the change at point Xs has the option of realizing the output indicated by point Ys at the same labor intensive mode of production, or of translating its gain into the form of a different working and living pattern, such as would be represented by point Z on the old production function, (given more land in place of the land saving technology) with no increase in output at all. Most likely, in practice, it would choose some new combination of output and work and living patterns between these two extremes until such time as any further increases in its dependent household members may dictate otherwise; both responses are consistent with economic progress.[26]

Earlier the point was made that farmers who deserve to be classified as commercial farmers can generally be expected to be capable of financing their fair share of the cost of any land or water development project from which they stand to gain. It was also suggested that the same does not necessarily apply to projects designed for the subsistence farming sector. A quite legitimate social purpose in this case is the redistribution or wider dissemination of income and economic security as an alternative approach to other forms of social welfare and immediate employment creation. In other words, such a project can be viewed as a form of social security for the poor, whereby a productive asset is provided to them, or is improved in their behalf, as an alternative to providing them with direct claims to consumption goods in the form of cash welfare payments. It is also akin to such programs as publicly-supported education for the poor, where the latter is viewed as an investment, the return for which is not really to be evaluated in terms of normal market criteria, since it is at best only peripheral to the existing market system. Rather, it is to be evaluated in terms of the subsequent capacity of the beneficiaries to support themselves and the degree to which it establishes a more effective base upon which other development projects with self-supporting and exchange oriented characteristics can be built.

What this implies is that the financial aspects of subsistence sector land development projects should be considerably simpler than those directed at the commercial farming sector, since in the former case provisions for repayments from the beneficiaries need not be required. On the other hand, a whole range of questions, largely peculiar to the subsistence sector, do need to be addressed as a means of ensuring that the beneficiaries exploit the full productive capacity and social security potential of the resources that are upgraded and made more widely available by such development projects. These extend into many policy areas such as land tenure, production credit, agricultural extension, general education, marketing facilities, cooperation and local government, and not by any means the least important, the involvement of local labor resources in the implementation of the project itself. In each of these areas the types of policies that are relevant, with respect to the subsistence farming sector, may be quite different, and in some cases, quite the opposite of those that are relevant to the commercial farming sector.[27]

On the basis of the foregoing discussion, it can be concluded that a considerable potential exists purely within an agricultural framework both for providing immediate assistance to the rural poor and also for expanding upon the potential of the subsistence sector either to accommodate further increases in numbers or to help raise basic levels of subsistence over time. As an alternative to allowing a continuing expansion in the world's population of landless rural households or an excessive rate of rural-urban migration and the associated additional strains this would place on urban welfare services and political stability, small farm-oriented development programming clearly deserves considerably greater priority than it has been accorded heretofore.[28] And it is also to be concluded that such a thrust need not, and should not, be pursued at the expense of an expanding and dynamic commercial farming sector which is essential to any developing country. Both farming sectors can, and should be, developed side-by-side, in accordance with the appropriate relative priorities that each deserves, given the particular demographic circumstances and stage of development that prevails in any given country.

However, to return to an earlier point, it is quite essential, in the planning and implementation of any agricultural development project in the subsistence farming sector, never to lose sight of the fact that, in the long run, the households involved must be able to look to expanding "off-farm" and largely "non-farm" employment opportunities as their principal means of escape from poverty and of entry to the modern exchange economy.[29] Over and above anything that can be done initially to raise the quality of their land and their access to other productive inputs, such as artificial fertilizers and improved crop varieties and livestock strains, supplementary non-farm income streams must also be made available to the dependent small farm households. This should be done for as long a period as possible, without disrupting the rural household's involvement in farming. This is to say, the emphasis must be placed on local, non-farm employment opportunities that supplement and complement the initial farming opportunity in such a way as to move the households step-by-step from a full subsistence farming orientation to a part-time farming status, and ultimately, in most cases, to a non-farming status. In this sense, the model for economic development in most of the densely populated, poorer countries today is provided more by Japanese economic development than by

most other developed countries. This model is of special significance because of Japan's unique limited land base and the sustained impact of traditional economic relations on its evolving, increasingly productive economic system.[30]

Consistent with this line of reasoning, it can be stated as an essentially inviolate rule, that no land and water resource development program directed to the subsistence farming sector should be approached as a purely agriculturally related venture, even within the farming area that it is designed to serve. It is well understood that most water development projects, even those designed to serve commercial farms, take on a so-called multi-purpose nature. But with respect to the subsistence farming sector, the need for multi-purposeness encompasses additional and fundamentally different dimensions. What is involved in this case is not so much a search for additional market outlets for the output as a means of financing a project that might not be supportable solely on the basis of projected taxes or charges levied on farmer users, as it is a search for new employment opportunities or complementary resource development activities that might be generated at the same time as the productivity of the farming land is raised. This is a big subject and one for which no single prescription can be written that is likely to be applicable in all circumstances. However, by way of conclusion a few more obvious considerations relating to it will be mentioned.

First in order is the special opportunity that is presented for using small farm irrigation and drainage projects as a means of establishing concentrations of the underemployed populations in rural areas which can form nuclei for new urban-industrial centers. Clearly, this possibility can be more effectively exploited if water resource development projects are evaluated and designed initially with this long-term goal in mind. Also, more rapid and relevant secondary benefits are likely to accrue if training programs are immediately developed in such subsistence farming communities which are relevant to potential non-farm employment opportunities in the area, and especially those that might be built upon the existing arts and crafts of these nuclei small farm communities.

Secondly, and more immediately, there is the already mentioned possibility of maximizing the utilization of local labor resources in the implementation of resource development projects and complementary forms of local infra-structure. Such an

emphasis is consistent with the growing recognition of the reciprocal economic benefits that are to be derived from linking public works projects with rural employment creation needs and the higher priority that generally needs to be given to rural infra-structure in development planning and investment.[31]

Finally, a point that is clearly implied by the above line of argument deserves explicit emphasis. This is the need for a broad spectrum approach to project design and implementation in subsistence farming areas. Because of the involved physical and social interrelationships that have to be dealt with in such areas, new forms of cooperative endeavor on the part of scientists, educators, government planners, and administrators need to be devised to meet the special challenges that these involve. Equally important is the counterpart of this need at the local level. In development programming the commercial farmer can best be related to through the market place and largely on a one-to-one basis.[32] The subsistence farmer and the local economy to which he belongs present a much more complex phenomenon. While this class of small farmer needs the independence and security that is implicit in private property rights in the land he has at his disposal, it is also true that he cannot realize the full benefits that are to be derived from resource development, whether physical or human, except on the basis of cooperation with his neighbors.

In the long run, what is really possible on the frontiers of opportunities outlined above will be dependent in great degree upon organizational creativity both within the universe of the small farmer and among those who seek to help the inhabitants of this heartland of world poverty move toward a fuller share in the fruits of economic progress. The Egyptian and Peruvian Farming Cooperatives, the Chilean asentamiento, and the Ejido and Puebla Project in Mexico, among others, represent relevant pioneering institutional experiments in this regard and need to be evaluated in these terms. On the basis of the general argument presented, it is to be anticipated that in most of these cases the amount of land distributed per household will be found to have been excessive and the emphasis placed on associated local non-farm employment creation to have been quite inadequate relative to the demographic reality and long run developmental needs of the environment which they have been designed to serve.

FOOTNOTES

[1]"Subsistence" as used in this context has a double meaning. It indicates a type of economy--a way of living--in which production mainly serves the direct consumption needs of the members of the producing enterprise or local economy. It also implies a low, or survival, level of living. The two conditions are normally associated one with the other--just as the dual features of most "commercial" economies are: production for exchange and higher levels of living.

[2]V. Dubey, "The Marketed Agricultural Surplus and Economic Growth in Underdeveloped Countries," The Economics Journal 73 (December 1963): 100.

[3]Peter Dorner and Herman Felstehausen, "Agrarian Reform and Employment: The Colombian Case," International Labour Review 102 (1970): 225; for comparable data on certain other Latin American Countries, see Solon Barraclough and Arthur Domike, "Agrarian Structure in Seven Latin American Countries," Land Economics 42 (1966): 395-402.

[4]U.S. Department of Commerce, Bureau of The Census, Census of Agriculture (Washington D.C.: Government Printing Office, 1964).

[5]Radaje Nikolitch, "The Adequate Family Farm--Mainstay of the Farm Economy," Agricultural Economics Research 17 (July 1965): 84-89; Luther Tweeten, Foundations of Farm Policy (Lincoln: University of Nebraska Press, 1970), pp. 179-180.

[6]Based on data drawn from, Carl C. Malone, Background of Indian Agriculture and India's Intensive Agricultural Program (New Delhi: The Ford Foundation, 1969), pp. 4-5.

[7]C. H. H. Rao, "Alternative Explanations of the Inverse Relationship between Farm Size and Output per Acre in India," Indian Economic Review, New Series, Vol.1 No.2, (October 1966): 5-9.

[8]Malone, Background of Indian Agriculture ..., p. 4.

[9]J.A. Newth, "Soviet Agriculture: The Private Sector, 1950-59," Soviet Studies 13 (October 1961): 160, 171.

[10]Raymond J. Penn, "Public Interest in Private Land," Land Problems and Policies, Eds. John F. Timmons and William G. Murray (Ames: The Iowa State College Press, 1950): pp. 219-233; Ibid "Public Interest in Private Property (Land)," Land Economics 37 (1961): 99-104.

[11]Particularly if he can draw upon a ready supply of low wage and seasonal labor or on sizeable public subsidies through price support programs and the like, see Edward Higbee, Farms and Farmers in an Urban Age, (New York: The Twentieth Century Fund, 1963): p. 89; Luther Tweeten, Foundations of . . . ., p. 318.

[12]Colin Clark, The Conditions of Economic Progress (London: MacMillan, 1951): pp. 395-439; and , Population Growth and Land Use, (London: MacMillan, 1967): pp. 279-338.

[13]Any marginal commercial farm that fails to meet the minimum returns to labor (however defined) for this sector but which continues to operate (as a subsistence farm) is in this sense "rejected" by the commercial farming sector. See also, T.W. Schultz, "Reflections on Poverty within Agriculture," Journal of Political Economy 58 (1950): 1-15.

[14]"The urban poor are only an overflow of the rural poor into the urban area." V.M. Dandekar and Nikalantha Rath, Poverty in India, (Bombay: Indian School of Political Economy, 1971): p. 17 and 137.

[15]Folke Dovring, "The Share of Agriculture in a Growing Population," Agriculture in Economic Development, Eds. C.K. Eicher and L.W. Witt, (New York: McGraw Hill, 1964), p. 97; Yujiro Hayami and Vernon W. Ruttan, Agricultural Development: An International Perspective, (Baltimore, London: The Johns Hopkins Press, 1971), p. 101.

[16]Harald Munthe-Kaas, "The Landed and the Hungry," Far Eastern Economic Review 68 (March 12, 1970): 27-30; Martin E. Abel, Agriculture in India in the 1970's, (New Delhi: The Ford Foundation, February 2, 1970), p. 10.

[17]"What is to be the future of the many uneconomic holdings and of the many more that may be added by imposition of low ceilings and redistribution of the surplus land to the landless?. . . It will be beyond the means of the new holders to develop these lands. No amount of credit . . . can make these uneconomic holdings economically viable." Dandekar and Rath, Poverty in India, p. 87; however, it should be noted that there still are advocates of drastic land reform who imply that any small arm thereby established can be transformed into a viable commercial farm with the aid of new yield-improving technologies; for example, see William C. Thiesenhusen, "Population Growth and Agricultural Employment in Latin America with Some U. S. Comparisons," American Journal of Agricultural Economics 51 (1969): p. 49.

[18]U.S. Department of State, A.I.D., Unemployment in Less Developed Countries, A.I.D. Discussion Paper No. 16 (Washington D.C.: June 1967); Dovring, "The Share of Agriculture ..." pp. 95-98.

[19]Thiesenhusen, "Population Growth ..." p. 737; Michael Todaro, "Industrialization and Unemployment in Developing Countries," Paper prepared for workshop on "A Widened Perspective of Modernizing Agriculture," New York State College of Agriculture, Cornell University, June 2-4, 1971, pp. 2-5; David Turnham, The Employment Problem in Less Developed Countries Employment Series No. 1 (Paris: O.E.C.D. Development Centre Studies, 1971).

[20]Kenneth Boulding, "Reflections on Poverty," The Social Welfare Forum (New York: Columbia University, 1961), p. 45.

[21]John Stuart Mill, Principles of Political Economy, W.J. Ashley, ed. (London: Longmans, Green and Co., 1936); Bk. 1, Chp. 9; Bk. 2, Chps. 6, 7.

[22]This relationship is implicit in comparative data compiled by Peter Dorner and Don Kanel, ("The Economic Case for Land Reform: Employment, Income Distribution and Productivity," Land Reform in Latin America, ed. Peter Dorner, Economic Monograph No. 3 (Madison: University of Wisconsin, 1971), pp. 52-53. However, the overall farm size/land productivity function hypothesized in Figure II is quite different from what has been deduced to apply from such data by these and other authors; namely, a negative, or at least the absence of a positive, correlation throughout the middle range of the function /see Dorner and Kanel, "The Economic Case...," p. 51; and William C. Thiesenhusen, "Technological Change and Income Distribution," Paper prepared for the Sixth Inter-American Conference on Agriculture, (Lima: O.A.S., May-June, 1971), p. 20, 21./ The latter interpretation clearly suggests that any form of land redistribution from "large" to "small" farms is likely to result in increased agricultural productivity (Ibid, pp. 20, 21). However, as is argued in the text, while there are good reasons to assume that there are two ranges of farm sizes in all countries over which a negative correlation generally does exist between increasing size and land productivity, it is also reasonable to assume that commercial farms operating near their optimum size and at the forefront of technological progress in this sector will pursue and record high levels of output per acre as one of the important ingredients of their continuing competitive efficiency. A productivity function of the shape presented in Figure II and paralleling the breakdown of the farm economy presented in Figure I accommodates this possibility. It also suggests an explanation for why many radical land redistribution programs have not resulted in the increases in production that were originally anticipated by their proponents. This is the likelihood that requisitioned land, in many of these cases, has tended to be redistributed in units that fall in the low productivity zone between the subsistence and commercial farming optima for the countries concerned. This being so, it is also not surprising that the supply of requisitioned land has frequently tended to be exhausted well before all of the landless could be accorded a share. The Egyptian, Indian and Mexican land reform programs are all illustrative cases of this latter phenomenon.

[23]Georgescu-Roegen, "Economic Theory and Agrarian Economics," Oxford Economic Papers 12 (February 1960), pp. 23-26, 33-40; see also, William H. Nicholls, "The Place of Agriculture in Economic Development," Agriculture in Economic Development, eds. C.K. Eicher and L.W. Witt, (New York: McGraw-Hill, 1964), pp. 42-44.

[24]Clifford Geertz, Agricultural Involution: The Process of Ecological Change in Indonesia, (Berkeley: University of California Press, 1966), pp. 124-130.

[25]Georgescu-Roegen, "Economic Theory and . . . ," p. 31; Geertz, Agricultural Involution . . . pp. 98-100; see also, John John A. Larkin, "The Causes of an Involuted Society: A Theoretical Approach to Rural Southeast Asian History," The Journal of Asian Studies 30 (1971): 783-795.

[26]Consistent with earlier remarks (footnote 22) the new function in Figure III suggests that the potential returns to biological and chemical type technologies are as likely to be realized as well, if not better, by efficient commercial farmers in any country as they are by subsistence farmers and especially so to the extent that related research, extension and credit programs and existing irrigation facilities are biased in the direction of the former. Such has been borne out in the early history of the Green Revolution. For example, see Abel, Agriculture in India . . . p. 22 and, United Nations, Economic Survey of Asia and the Far East, (New York: 1968), p. 109, 130. The function as presented in Figure III also suggests that the categories of farms that are least responsive to new land saving technologies are likely to be those that lie at the two extremes and between the commercial and subsistence optima ranges. In addition Yc is likely to lie to the right of Xc and Ys to the left of Xs after the technological change has been absorbed, for the reason that the adoption of a land-saving technology is likely to be linked with the adoption of associated labor-saving technologies in the commercial sector, and not so in the subsistence sector.

[27]Some of these contrasts are drawn in a previous paper. See, Wyn F. Owen, "Two Rural Sectors: Their Characteristics and Roles in the Development Process," Rural Politics and Social Change in the Middle East, eds. Richard Antoun and Iliya Harik (Bloomington: Indiana University Press, 1972): 410-417.

[28]This idea is, of course, not entirely new. It was inherent in the "small holder movement" in England in the late 19th century and early 20th century (see, R.M. Garnier, Annals of the British Peasantry, (London: S. Sonenschein, 1908), p. 352); it has also emerged more recently in the context of Indian development planning (see, Dandekar and Rath, Poverty in India, p. 69-75). It is interesting, however, that Dandekar and Rath themselves (Ibid., pp. 86-87) fail to recognize the full potentialities of the small, subsistence farming sector and its essential role in the development process in densely populated developing countries. The small holder movement proved to be far more transitory as a social welfare component of the English economy than is likely to be the case in most developing countries today. Dorner and Feltsehausen also argue for the expansion and encouragement of a small farm sector at the expense of at least part of the large farm sector in Latin America. (Dorner and Feltsehausen, "Agrarian Reform and Employment," p. 235). However, in their case, it would appear that they have in mind dual commercial farming sectors rather than a commercial farming sector on the one hand and a subsistence farming sector on the other, with the latter being viewed in the long run as mainly transitional to non-farming employment opportunities rather than to commercial farming.

[29]There is, of course, some limited opportunity to be exploited in the form of supplementary employment of members of subsistence farming households as wage-workers--especially as seasonal wage-workers--on commercial farms. However, this opportunity has always existed and has always been limited. It is precisely because of its limited nature that landless or near landless rural laborers dependent upon it for survival have been subject to the forms of labor exploitation that are endemic to the plantation-latifundia types of farming systems.

[30]Takekazu Ogura, Agricultural Development in Modern Japan, (Tokyo: Fuji Publishing Co., 1967), pp. 638-639; Takeo Misawa, "An Analysis of Part-Time Farming in the Post-War Period," in Agricultural and Economic Growth: Japan's Experience, eds: K. Ohkawa, et al, (Tokyo: Princeton University Press/University of Tokyo, 1970), pp. 250-269.

[31]A concept well articulated in the United Nations Food and Agricultural Organization, F.A.O. Mediterranean Development Project (Rome: 1967), p. 59-60; see also, T. Balogh, "Agricultural and Economic Development: Linked Public Works," Oxford Economic Papers 13 (1961): 27-42, and, Dandekar and Rath, Poverty in India pp. 127-134.

[32]Francine R. Frankel, "India's New Strategy of Agricultural Development: Political Costs of Agrarian Modernization," Journal of Asian Studies (1969): 693-710; T.W. Schultz, "What Ails World Agriculture?" Bulletin of The Atomic Scientists (January 1968): 32-33.

Chapter III
Some Aspects of Resource Management by Traditional Farmers+

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This paper will ignore economic and agronomic aspects of farming and instead, will concentrate on traditional management of five agricultural resources: water, slope, soil, climate, and space. Since these elements constitute resources for farmers everywhere, the distinction between traditional and modern must lie in management. I propose an operational definition of farming not in terms of economics (i.e., subsistence or commercial) or of scale (i.e., small or large), but in terms of resource management based upon differences in information and energy sources. Traditional farmers rely upon individual or local group knowledge of resource characteristics, and upon locally available energy and materials for resource management. Modern farmers rely heavily upon information from scientific and educational institutions, and upon supplies of fuels, chemicals, equipment, and other inputs from outside the local community.[1]

These distinctions lie at the heart of conventional development analysis. Lack of scientific information condemns traditional farmers to existing techniques,[2] which combined with a lack of energy supplements (or subsidies[2]), results in low productivity per worker. These apparent disadvantages are well known. Why then discuss traditional resource management except in an historical or anthropological context? The following points should be considered:

1. Some traditional farming systems have enviable resource management and conservation records, others do not. Those that have existed over time, however, represent at least partially successful solutions to particular sets of man-environment situations. Borrowing from the gene pool concept of biology, we must assign value to these experiments even if at the moment they appear somewhat anachronistic.

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2. Reliance upon locally available energy sources, primarily human and animal muscle, is to Western eyes one of the most onerous aspects of traditional systems. Labor-intensive methods, however, may be attractive in labor-abundant societies where unemployment is a major problem.[3] In the longer run increasing dependence upon fossil fuels that are becoming scarce and expensive may be poor policy, especially for those countries that lack advantageous positions in increasingly competitive fuel markets.[4]

3. Traditional technology has little to attract Western engineers and businessmen. Yet since it represents the means by which the labor of millions of humans and animals are used, and by which millions of hectares are managed, even small improvements would be significant for the world as a whole.[5]

4. Traditional methods that might be more widely used enjoy some advantages over modern techniques. Capital and technological skill requirements are low, and adoptions often require little restructuring of traditional societies.[6]

5. Resource management systems developed locally need to be evaluated carefully before they are replaced. Modern methods, largely of mid-latitude origin, may have unexpected and often undesired impacts in different environments.[7]

To say that traditional farmers lack access to modern science and technology is not to say that they are unknowledgeable about resource management, that they do not engage in extensive and in many cases, highly sophisticated management practices, or that their management techniques fail to increase productivity or to maintain or improve resource quality. However, the constraints within which traditional farmers operate pose special problems and call for special solutions.

Traditional systems are characterized by their reliance upon locally available information, energy, and materials. At the working level, resource management can be viewed largely in terms of energy available for movement of materials (mass

transfers). The main energy sources are human and animal muscle, augmented by gravity whenever possible, and supplemented in some cases by water or wind currents. Vertical and horizontal transfers of soil and water are the primary mass transfers involved. Since water usually is transfered by gravity flow, much of traditional resource management can be reduced to energy requirements for moving soil and other solid materials.

Because of the power limitations of single units (i.e., humans, animals), the advantages of group rather than individual effort are apparent whenever sizable transfers of mass are required. A variety of cooperative and coercive work systems are found in the traditional world. Depending upon the size of task, resource management may call for combined efforts of families, villages, or even whole societies. Marshalling energy for resource management has had a strong influence upon social organization in many traditional societies. The many special needs and opportunities of water management seem especially powerful in this regard. [8]

An alternative solution is to reduce scale, to divide tasks into manageable units that can be accomplished by individuals or small groups. Traditional farms, for example, characteristically are small, matching in size the available human or animal power units. There is no simple relationship, however, since farm size is only one indicator of work requirements. Intensity of resource management also must be considered.

Both the approaches of combined effort and reduction of scale, have advantages and disadvantages. At some point labor management problems limit the size of group that effectively can be applied to a given task. On the other hand, many resources are better managed on a scale considerably larger than the farm or village. In such cases individual or small group efforts may be negated by conditions and events outside the area of administration. The alternatives of combined effort or reduction of scale will be examined again in the sections on specific resource management.

With these conditions in mind, let us turn to a brief review of particular resource management practices in traditional societies. The discussion will consider only general characteristics, with a few practices as examples. To survey even cursorily the

vast field of specific technology in traditional resource management would require much more space than is available here.

WATER MANAGEMENT

Management of water resource includes some of the oldest and most widespread of traditional practices. This stems in part from the fluid nature of water which permits the use of gravity to perform such work functions as collection, transfer, and application. Most traditional systems simply interrupt and reorganize the overland portion of the hydrologic cycle to secure a supply of irrigation water.

Water storage in traditional systems usually is limited to natural storage areas, such as river beds, lakes, or intermittent streamways. Dam construction and flow control problems make the use of large valleys as single reservoirs uncommon. In some cases, however, a series of smaller dams are used to bring whole basins under control. Excavation of sizable reservoirs involves transfers of material beyond the capacity of most traditional societies.[9]

Water lifting devices that depend upon human or animal power, such as shadoofs, water ladders, or Persian wheels, are limited in the height and volume of water that they can raise. On these counts they compare poorly with modern engine- or motor-driven pumps. In small irrigation systems, however, where lift and volume requirements are low, total cost per cubic meter of water delivered may be less for the hand- or animal-powered methods.[10] Interesting possibilities exist for improving the design of these devices, and of coupling them to low-cost power sources, such as windmills.

Some groups employ the power of wind, or of the streams themselves to lift water. The early use of windmills to drain the Dutch polders is an outstanding example. The potentials and possibilities for modern application of such devices has been little investigated, regretably since they offer obvious advantages to farmers with limited access to fossil-fuel powered systems.[11]

Water delivery systems almost universally depend upon gravity flow through open channels. While tunnel and closed

conduit construction is not unknown in the traditional world, they do pose difficult engineering and maintenance problems for societies lacking in sophisticated surveying and excavating equipment.[12] Open canal construction, on the other hand, is well within the capabilities of most groups or even individuals. Excavation rates for men using only shovels varies with type of material and construction. A range of 3 to 7 cubic meters per man-day, depending upon rock content or degree of consolidation, is reasonable if not conservative.[13]

While water is most often applied at the surface, hand sprinkling and sub-irrigation systems are not uncommon.[14] Decisions regarding amounts and timing of irrigation water are based upon folk knowledge of plant requirements and soil characteristics, within the constraints of particular allocative systems. A wide range of water allocation systems exist, including those based upon prior rights, and egalitarian or elitist principles. While traditional water allocation and application practices may be rational within the context of the culture, they do not necessarily represent best solutions in terms of plant productivity. Modern soil and plant science along with systems analysis could be of great benefit in this area.[15]

In addition to limitations of available energy, water management in many traditional societies is characterized by limitations of scale. Authority for resource management often extends only to the lands of a village or a small region; rarely do traditional administrative units cover a complete drainage basin. Thus there is a marked inability among fragmented traditional groups to develop basin-wide planning and management. Opportunities exist for integrating small irrigation systems even without introducing large-scale engineering works.[16]

SLOPE MANAGEMENT

Slope management and field leveling are closely related to water management, especially in systems where erosion control and irrigation are practiced. The same considerations of energy requirements for mass transfers apply: the low energy level of traditional societies inhibits large-scale operations. Slope management, however, does not seem to exercise as strong an organizing influence as water management. A few well organized

societies (e.g., People's Republic of China) combine the efforts of large work gangs for terracing and field leveling. In most traditional societies, however, scale is reduced and slope management is performed by individuals or small groups.[17]

Terracing is perhaps the most widespread and best known form of slope control. Terrace systems in the Philippines and Andean Peru, for example, have attracted much attention and admiration.[18] Despite their popularity surprisingly little is known about traditional methods and labor requirements for terrace construction. Less spectacular techniques include contour plowing, ridging, mounding, and use of planted vegetation to control downslope runoff and erosion.[19] In a few areas traditional farmers create small level fields by inducing deposition behind silt-trap dams.

Field leveling presents special problems to traditional farmers. Surveying instruments are usually scarce. Leveling even small fields requires the transfer of substantial amounts of material. Some industrious farmers undertake field leveling with shovels and animal-carried baskets. Whenever possible, however, animal-drawn scrapers, wagons, or powered equipment are used.

Slope control offers several opportunities for research and development. Simple surveying equipment and improved animal-powered equipment, for example, would be of great assistance. The possibilities for increased cooperative effort should also be explored.

SOIL MANAGEMENT

An impressive array of soil management techniques are employed by traditional farmers. Since bulk transfers are relatively small in most cases, there is little need for combined effort. Soil management is customarily done by individual farmers. Knowledge of soil characteristics and treatments, of course, is a product of long group experience with particular types of soils.

Soil fertility is improved by a variety of animal, human, and green manures, usually produced within the farm area. Some groups add lime, sand, gravel, and other substances to improve soil characteristics. When bulky additives are applied, hand or

animal carried containers (e.g., baskets, panniers) are replaced by wagons or even trucks if possible.

Various plowing and cultivating practices affect tilth for better or for worse.[20] Field forms, such as ridges, furrows, and mounds also control surface geometry with consequent effects on surface heating and moisture retention (see following section on climate management). Mulching is widespread.

The level and extent of traditional soil sciences are relatively uninvestigated. The few reports available suggest empirical knowledge of soils, and soil classification systems of considerable sophistication.[21] Yet the record of traditional soil management is mixed: some groups cultivate soils that have been productive for centuries, using techniques that conserve and improve soil quality.[22] Others seem committed to the most destructive of practices that degrade soil quality and accelerate erosion. While folk soil science is an important element in explaining differences, social and economic considerations, such as population pressure, land tenure, and market opportunities undoubtedly are factors. There is a real need for comparative studies on this subject.[23]

Finally, most traditional farmers could benefit from a more exact understanding of soil properties and deficiencies in their individual plots. The problem is one of scale; not of energy or material inputs but of information. While most soil treatments, such as manures or chemical fertilizers, are easily divisible, it is difficult to repackage modern soil testing methods so that they can be applied inexpensively to many small plots.[24]

CLIMATE MANAGEMENT

Traditional farmers are no more able to cope with enormous energy fluxes and mass transfers involved in macro- or meso-scale climates than are their industrialized counterparts. By reducing scale, however, they achieve considerable control over individual plant or small plot microclimates. Short and long wave energy transfers are regulated with standing native shrubs and trees, multi-storied crop plants, or shading structures. Heat and moisture fluxes are controlled with ridges, mounds, heating walls, mulches, and tillage practices. Windbreaks and surface covers

shield plants from the force of wind, rain, and hail, and maintain microclimates by reducing turbulent mixing.[25]

Since management of crop microclimates is mostly a matter of regulating flows of heat and water vapor, rather than of transfering masses of material, the traditional farmer is little hindered by the limited energy available to him. In fact, the intimate environments of small plots probably are more amenable to modification than are those of large fields. Specific information on climate meliorating practices, however, is deficient. Measurement with modern instruments would be of great help in establishing the effectiveness of traditional techniques, especially as they may extend crop limits and growing seasons.

SPACE MANAGEMENT

Although the traditional farmer lives and works in a relatively small world, distances and spatial arrangements enter into his decisions. Thus he must consider the distance from farmstead to village or market, distances and distribution of fields in relation to farmstead, and spatial organization of crops within individual fields.

Time and energy required to transfer farm inputs and outputs from source to destination can be expressed as transportation costs and included in farm production costs. Thus location is an attribute of land, just as are soil quality or water availability, and is reflected in land prices and land use intensity. The economic aspects of location, especially as they relate to land use, are dealt with in the extensive literature of location theory and need not concern us here.[26]

Within the range of customary crops and cropping practices, farmers have considerable latitude in managing space at the individual plot level. Crop rotation patterns, for example, some of which are on remarkably tight schedules, are common in many traditional systems. Intercropping, including multi-storied cropping, maximizes use of both horizontal and vertical space in small fields. This practice, which is ecologically sound, is another example of management alternatives that are important in labor-intensive farming systems but which are limited or excluded from machine-worked fields.[27]

Management of space offers some particularly attractive research opportunities. Several proposals for organizing the space of national territories as a development measure have appeared and merit careful consideration.[28] While location theory helps explain land use decisions as affected by distance from market, it is unclear how such decisions are influenced by the degree of subsistence production. Nor is it known what effects periodic or seasonal markets have on agricultural production and land use. These markets, which are common in many traditional economies, rotate on a regular basis and introduce a farm-market distance factor which changes or pulses over the market cycle.[29]

While the economics of space is important with respect to land use, "traditions" in such forms as settlement custom and land tenure limit farmers' locational prerogatives. At the individual plot level, however, traditional farmers have considerable flexibility. Over time they have developed ecologically advanced and productive techniques, and perhaps have more to teach than to learn about space management.

CONCLUSION

Perhaps the main point to emerge from this brief survey is that traditional systems can and should be systematically investigated and evaluated. While energy aspects were stressed, traditional systems also are amenable to economic analysis, providing all factors, including social costs and benefits, are included. Given the present size and probable longevity of traditional sectors,[30] it would seem prudent to include investigations and appraisals of traditional resource management methods--the methods evolved in low-energy, small-farm environments--in any development plan. As long as these environments endure, traditional technology offers valuable alternative approaches to agricultural resource management.

FOOTNOTES

[+]Work on traditional resource management systems has been encouraged by participation in the A. I. D. 211(d) program at Colorado State University. Further study currently is being supported by the Foreign Area Fellowship Program and the National Science Foundation.

[1]Similar definitions for "paleotechnic" and "neotechnic" have been proposed. See: D. R. Harris, "The Ecology of Agricultural Systems," in Trends in Geography, An Introductory Survey, eds: Ronald U. Cooke and James H. Johnson (Oxford: Pergamon Press, 1969) pp. 133-142. Such dichotomous definitions admittedly ignore the actuality of a continuum: few traditional farmers are completely lacking in knowledge or materials of non-local origin, and most modern farmers use substantial quantities of inputs from "traditional" sources. Nevertheless, such polar definitions have a certain utility in general discussions. They are less useful in actual case studies.

[2]Howard T. Odum, Environment, Power, and Society (New York: John Wiley & Sons, Inc., 1971), p. 115.

[3]Edgar Owens and Robert Shaw, Development Reconsidered (Lexington, Mass.: D. C. Heath and Co., 1972), pp. 57-63.

[4]J. C. Dickinson, III, "Alternatives to Monoculture in the Humid Tropics of Latin America," Professional Geographer 24 (August, 1972): 217-222; David Pimental et al., "Food Production and the Energy Crisis," Science 182 (November 2, 1973): 443-449.

[5]A. H. Bunting, ed., Change in Agriculture (New York: Praeger Publishers, 1970), pp. 736-737.

[6]United Nations, Food and Agricultural Organization, Farm Implements for Arid and Tropical Regions, by H. J. Hopfen, FAO Agricultural Development Paper No. 91 (Rome: Food and Agricultural Organization of the United Nations, 1969), pp. 1-3.

[7]United Nations, Food and Agricultural Organization, Soil Erosion by Wind and Measures for its Control on Agricultural Lands, FAO Development Paper No. 71, (Rome: Food and Agricultural Organization of the United Nations, 1960), p. 69.

[8]Edmund Leach, Pul Eliya: A Village in Ceylon (London: Cambridge University Press, 1961); Réne Millon, "Variations in Social Responses to the Practices of Irrigation Agriculture," in Civilizations in Desert Lands, ed.: Richard Woodbury (University of Utah: Department of Anthropology, 1962), pp. 56-88; and Karl A. Wittfogel, Oriental Despotism: A Comparative Study of Total Power (New Haven: Yale University Press, 1957).

[9]Even modern societies with powered equipment find excavation costly. Thus it is often economically more justifiable to construct a new dam downstream than to excavate alluvial deposits from a silted reservoir.

[10]United Nations, Food and Agricultural Organization, Water Lifting Devices for Irrigation, by Aldert Molenaar, FAO Agricultural Development Paper No. 60 (Rome: Food and Agricultural Organization of the United Nations, 1956).

[11]J. M. Ionson, The Field Performance of a Windmill Powered Sprinkler Irrigation System, Publication No. MT8 (Brace Research Institute: McGill University, August, 1969).

[12]The justly famous qanats, or filtration galleries, are outstanding examples of traditional engineering. Qanat construction and maintenance require specialized tools and workers. See: George B. Cressey, "Qanats, Karez, and Foggeras," Geographic Review 48 (January, 1958): 27-44.

[13]Charles J. Erasmus, "Monument Building: Some Field Experiments," Southwestern Journal of Anthropology 21 (Winter 1965): 277-301; and J. Muller, "Labour-Intensive Methods in Low-Cost Road Construction: A Case Study," International Labour Review 101 (April 1970): 359-375.

[14]Gene C. Wilken, "Drained-Field Agriculture: An Intensive Farming System in Tlaxcala, Mexico," Geographical Review 59 (April 1969): 215-241. A system is reported from Mexico in which water is lifted and applied directly to plants by hand. See:

Kent V. Flannery, Anne V. T. Kirkly, Michael J. Kirkly, and Aubrey W. Williams, Jr., "Farming Systems and Political Growth in Ancient Oaxaca," Science 158 (October, 1967): 445-454. While such "pot-irrigation" makes possible three harvests a year, the energy required must limit this method to very small plots.

[15]The possibilities of such an approach are evident in the following study: Raymond L. Anderson and Arthur Maass, "A Stimulation Technique to Estimate Crop Production of Irrigation Water," International Commission on Irrigation and Drainage, Seventh Congress, 1970, pp. 23:547-23:558.

[16]Mexico, Secretaría de Recursos Hidráulicos, Ley Federal de Aguas, 30 Diciembre 1971, Publicación Legal No. 13 (Mexico, D. F.: SRH, Dirección General de Distritos de Riego, Dirección de Estadística y Estudios Económicos, January 1972), pp. 29-32.

[17]Wheatley argues that some terrace systems in Vietnam are expressions of preconceived and carefully executed plans. See: Paul Wheatley, "Agricultural Terracing," Pacific Viewpoint 6 (1965): 123-144.

[18]J. E. Spencer and G. A. Hale, "The Origin, Nature, and Distribution of Agricultural Terracing," Pacific Viewpoint 2 (1961): 1-40; and A. C. S. Wright, "Some Terrace Systems of the Western Hemisphere and Pacific Islands," Pacific Viewpoint 3 (1962): 97-101.

[19]Robert C. West, "Population Densities and Agricultural Practices in Pre-Columbian Mexico, with Emphasis on Semi-terracing," Verhandlungen des XXXVIII Internationalen Amerikanstenkongresses, Stuttgart-Muchen 12-18 August 1968 (Muchen: Klaus Renner 1970), vol. 2, pp. 361-369.

[20]Harry O. Buckman and Nyle C. Brady, The Nature and Properties of Soils, 7th ed. (New York: The Macmillan Co., 1969), p. 66.

[21]George Benneh, "Systems of Agriculture in Tropical Africa," Economic Geography 48 (July 1972): 244-257.

[22]Soils in some areas of Europe, for example, might best be classified as anthrosols or ethnosols since their primary characteristics are determined not by climate or parent material but by centuries of intensive traditional management.

[23]As an example, see Allen's remarkable survey of African farming systems. William Allen, The African Husbandman (New York: Barnes & Noble, Inc., 1965).

[24]Carroll Streeter, Reaching the Developing World's Small Farmers (New York: The Rockefeller Foundation, n.d.), pp. 27-31.

[25]Gene C. Wilken, "Microclimate Management by Traditional Farmers," Geographical Review 62 (October 1972): 544-560.

[26]Michael Chisholm, Rural Settlement and Land Use (London: Hutchinson University Library, 1962).

[27]Richard Levins, "Fundamental and Applied Research in Agriculture," Science 181 (10 August 1973): 523-524.

[28]E. A. J. Johnson, The Organization of Space in Developing Countries (Cambridge, Mass.: Harvard University Press, 1970).

[29]R. J. Bromley, "Markets in the Developing Countries," Geography 56 (April, 1971): 124-132.

[30]Thorkil Kristensen, "The Approaches and Findings of Economists," International Journal of Agrarian Affairs 5 (1967): 130-156, estimates that while between 1960 and 2000 the agricultural population in developed countries will decline from 115 million to 50 million, in the less-developed countries it will rise from 920 million to 1480 million.

Chapter IV
Primitive and Peasant Economies

John L. Schultz*

Many change agents assume that the primitive and/or peasant producer will respond to economic opportunities in the same fashion as many modern producers in more developed countries do. It is often assumed that producers will respond positively to new technologies which offer a greater economic reward for their efforts. However, profit motivation may be only one of a host of considerations which the individual weighs in making his decision regarding a new production practice. Cultural attitudes, values and institutional arrangements also have a great bearing on the individuals decisions. It is critical that change agents be aware of such attitudes and beliefs in order to design strategies which will optimize the possibility of the acceptance of change.

Over the past few decades, anthropological investigations into primitive and peasant economic systems have revealed that because they are based primarily on reciprocal exchange and redistributive exchange mechanisms rather than the market economy of Western societies, the peasant economy requires analytic consideration not readily provided by formal, economic analysis. Further, some social scientists such as Dalton[1], Firth[2], and Polany[3], have argued that formal economic theory has little place in attempting to understand primitive economic systems.

While other scientists have effectively argued the adverse, Burling[4], LeClair[5], and Cook[6], most scholars will tend to agree that primitive and peasant economies reflect cultural peculiarities which require considerable, theoretical modifications to allow for maximum understanding and predictibility. Similarly, when involved in planned, social change and progress for economic growth or development, one should be even more aware of the importance of understanding these cultural factors.

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Among primitives, the exchange system whereby goods are channelled from producer to consumer is marked by (1) reciprocity or material gift and counter gift giving induced by social obligations which are normally derived by kinship and/or (2) by redistribution or the channelling upward of goods and services to socially determined allocative centers where they are then redistributed to subordinates at large by means of community services or in specific allotments to individuals on the basis of such political, religious or military considerations.

In addition to the very rigid structure and strong social sanctions governing the production, distribution and consumption of goods among primitives are several other cultural factors which influence the perpetuation of tradition and reinforce "tried and true" economic behavior. Among these are (1) a high degree of cultural homogeneity and shared notions of acceptable vs. non-acceptable behavior, (2) the fact that the sanctions governing all types of conduct are sacred, (3) the absence of any economic motives which fail to conform to all other aspects of social life (e. g. egalitarianism, pacifism, etc.), (4) the underdeveloped and use specific nature of their markets where the advantage of competition would be minimal, (5) the lack of local demand for surplus production since virtually everyone produces the same range of articles, and (6) an oftentimes fatalistic world view and the tendency to view the inanimate world personally.

Regarding the notions of conformity and fatalistic world view, some explanatory comments are in order. Among primitives, virtually all aspects of life are functionally integrated and reflect on one or two primary values. For example, if egalitarianism or social equality is a dominant characteristic of the group, all social behavior tends to reflect this value. Further, strong religious and social sanctions are employed to ensure the egalitarian philosophy. Under these circumstances, from the point of view of the individual, the introduction of such concepts as competition, profit maximization and surplus accumulation would be very difficult at best. Further, if an individual were to engage in such behavioral practices, it would seriously affect the functional integration of the culture at the societal level because all components (economic, social, religious, etc.) have common threads providing the necessary integrative force. In most cases societies such as these also have a number of "wealth leveling mechanisms" which provide added protection against maximization of

resources. For example, usually the only individuals in a position to accumulate wealth are the chief and his lineally related relatives. Importantly, he is often evaluated and allowed to remain in the office on the basis of his generosity and must constantly disperse material goods among the rest of the society to retain his power and prestige.

In the case of world view, fatalism also acts as a strong protective shield against innovation. The belief is held that the fate of the future is outside the realm of the individual and is controlled by forces external to man. Thus, any efforts taken by individuals to improve crop yields or production capacities are futile since these are controlled by nature rather than in competition with nature as in the case of more developed economic systems. In some cases, this fatalism in personal world view is carried to the point that an innovation which is demostrated to work for one farmer or rancher is rejected by his neighbor because it is perceived to be individual specific.

Due to the above cultural characteristics, primitive societies have historically resisted large scale acceptance of production innovations. Even when such technologies have been superficially accepted, integration into the rest of the culture has been difficult and oftentimes has resulted in severe stress to the tradition and social structures. One need only to engage in a cursory examination of overseas projects sponsored by U. S. A. I. D., F. A. O. and the Peace Corps to see the large numbers of projects which have failed or enjoyed only limited success even though they were economically and technically sound.

Peasant economic systems reflect many of the characteristics noted in primitive systems even though they have been exposed to a literate tradition, a "state" civilization and a market economy. Redfield[7] provided a description of the basic values common to peasantries the world over. These included an intense attachment to native soil, a reverent disposition towards habitat and ancestral ways, a restraint on individual self-seeking in favor of family and community, and a certain suspiciousness of town life. While no doubt such loose generalizations may be of little value to production management strategists, these factors as well as the presence of a fatalistic world view, high risk and uncertainty, in terms of securing economic livelihood beyond a

marginal level, and a rigid and caste-like social structure, all tend to compete with economic criteria when considering innovation.

Perhaps the most important factor existing in peasant societies which may negate acceptance of innovation and stifle economic growth and development is the presence of a series of legal, structural and cultural "buffer mechanisms," designed to regulate social and economic distance between the peasant and the urban elite or other more prestigious groups. Holmberg[8] noted this phenomenon among the Peruvian peasants on the Vicos hacienda and Bernard[9] noted the same among Greek, sponge fishermen as I myself did among Arab pastoralists in Africa. In these cases, the "buffer mechanisms" maintain a delicate distance balance between two social poles; the peasant and the upper class or urban society. This mechanism is designed to keep the two groups from merging while at the same time keeping them from growing so far apart that the peasant is no longer an easily accessible labor or military force. Commonly, the acceptance of any economic innovations among peasants is fought by the elite group, since development would mean increased wealth, status, opportunities and power and thus, the security of their position would be threatened.

Initially, in the development of peasant "states," these buffers were legal in the sense that they were rules and laws designed to regulate the production, sale and distribution of farm products. Later, social buffers were created to reinforce or maintain the polar distance between peasant and urban elite. For example, the British in Africa introduced the village official and/or tax collector to act as intermediary between two cultures. This in turn led to a complex, bureaucratic structure which served to funnel goods and services from peasant to elite and to funnel information, rules, regulations and technological knowledge in the other direction. Interestingly, in most cases the rate of progress for the peasant is carefully controlled by the elite group and "too much progress too soon" is usually discouraged at the local level.

While in Africa, working among Arab, nomadic pastoralists, I noted a "buffer" in the form of the Kokuto sedentary villagers, who severly limited the Agency for International Development, who were trying to improve livestock practices. These villagers, in times past had been selected by the government of Chad and Cameroon to function as intermediaries at the local level. They had

been elevated to the prestigious positions of being functionaries between the government and the pastoral nomads. In time, this structural buffer led to strong, perceived cultural differentiations between the Kotuko and the Arabs with the former being perceived as the urban elite. Today, any efforts by the National Government or external agencies to improve the economic position of the pastoral nomads is strongly discouraged and/or undermined by the elite group for fear of creating a shift in the socio-economic balance of the two groups. Thus, in this instance the Kokuto buffer mechanism is a primary force in impeding innovation and economic development in the Chad-Cameroon region of West Africa.

In summary, among primitive and peasant societies, cultural values and attitudes, beliefs and behavior patterns often play an equal or greater role than economic considerations when deciding whether to accept or not new production practices. Kinship obligations, peer group pressure, fatalistic beliefs, negative social sanctions regarding accumulation or surplus, individuality, caste differences and constraints and the perpetuation of common, traditional values through family socialization, all represent serious challenges to the foreign change agent.

Interestingly, one need not seek out primitives or peasants to demonstrate that cultural factors influence economic decision-making. Recent research among Western livestock producers in the United States and Canada also demonstrates that profit maximization is but only one out of several goals pursued by ranchers (Schultz[10] and Bennett[11]).

Western economic systems apparently revolve around notions of "progress", profit maximization, cost minimization and labor-saving technological improvements among others. However, just as with non-western producers, innovation takes place slowly in the systems and extension agents as well as others are continually confronted by such values as conformity to traditional norms, the effects of peer pressure and color combinations that are not aesthetically pleasing. For these reasons, insufficient "tried and true" production techniques and the tendency towards subcultural, social isolation from urban society as well as other sectors of American agriculture present themselves.

In order to demonstrate the above assertions, an example from the U. S. beef producers would be illuminating. During 1969-

1970, livestock producers from four counties in Oregon and Washington were extensively interviewed as part of a U. S. Department of Agriculture research project. Essentially, the research centered around determining how cultural factors influenced economic decision-making. While much was learned regarding the interplay of values, attitudes and perceptions only the following conclusions need to be mentioned here. First, many ranchers operate under erroneous impressions of their individual operations as well as those of the livestock industry. For example, they perceive themselves as the only sector of American agriculture free of government involvement and are proud of the fact that they receive no federal subsidies. Also, many perceive that increased herd size is directly related to the amount of new land they would have to acquire rather than perceiving how they might be able to increase production on the land presently available.

Secondly, many of the more traditional ranchers in these states refuse to cross-breed as a production strategy because of tradition and peer group pressure. One often encounters statements like, "I'm a Hereford man. My grandfather was a Hereford man and so was his father before him--it's a tradition in this part of Oregon." They also admit to fearing the loss of esteem they would suffer in the area should they begin experimenting with "exotic" breeds.

Finally, among the more traditional ranchers (which make up a significant percentage of the ranching population) there seems to be an economic threshold in operation which is the critical economic level necessary to continue the cowboy lifestyle. If an individual falls below such a threshold then production innovations are accepted and put into practice. However, once they are economically above the critical level then further innovations are rejected and thought not to be necessary. Seemingly, for these individuals maximizing does occur but it is a lifestyle that is being maximized rather than profit. Thus, in this respect, they are no different than their primitive counterparts.

Clearly, the "Zane Grey" variety of cowboy is not a relic of the past but very much a part of American beef production. Until this fact is realized by extension personnel here and by change agents abroad, economic development programs will continue to be technically sound, economically beneficial (and perhaps even critical) but of limited and short term success.

FOOTNOTES

[1]George Dalton, "Economic Theory and Primitive Society", American Anthropologist 63 (1961), 1-25.

[2]Raymond Firth, Elements of Social Organization (London: C. A. Watts and Co. LTD, 1952).

[3]Carl Polany. "Trade and Markets in Early Empires", The Free Press (New York, 1958).

[4]Robbins Burling, "Maximization Theories and the Study of Economic Anthropology", American Anthropologist 64 (1962), 802-821.

[5]Edward E. LeClair, Jr., "Economic Theory and Economic Anthropology", American Anthropologist 64 (1962), 1179-1203.

[6]Scott Cook, "The Obsolete 'Anti-Market' Mentality: A Critique of the Substantivist Approach to Anthropology", American Anthropologist 68 (1966), 323-345.

[7]Robert Redfield, Peasant Society and Culture, (Chicago: University of Chicago Press, 1956).

[8]Alan Holmberg, "Vicos: A Peasant Hacienda Community in Peru", Social Change in Latin America Today, (New York: Random House Publications, 1960).

[9] H. Russell Bernard, Personal Communication, 1969.

[10]John L. Schultz, "Socio-Cultural Factors Influencing Economic Decision-Making Among Western Livestock Producers". Final Report to United States Department of Agriculture, Washington, D. C., 1971.

[11]John Bennett, The Northern Plainsmen. (Aldine Publishers, Chicago: 1970).

Chapter V
The Adoption of New Agricultural Inputs and Practices by Indian Farmers[1]

Linwood L. Hodgdon*

Due to the relatively slow rise of agricultural productivity and the rapid increase of a population already ill-nourished and afflicted with widespread poverty, India's agricultural sector has for many years been under great stress, even crisis. Moreover, the nation's economic growth is dependent upon achieving large increases in agricultural output. In heavily populated countries such as India, where land has been tilled for centuries, it has long been apparent that increases in agricultural output must come primarily from the adoption of more productive inputs and practices by millions of individual farmers. In view of the urgency of the nation's needs for continuing increases in food production, the factors affecting the adoption or non-adoption of more scientific inputs and practices are matters of major concern. To identify these factors was the primary objective of the original study on which this paper is based.[2]

ADOPTION IN THE UNITED STATES AND IN LESS-DEVELOPED COUNTRIES

Much adoption research[3] in agriculture in the United States has focused on the attributes of the individual farmer, the effect of different variables upon the rate of adoption, and studies of the various stages in the adoption process. The "innovator" has frequently been the object of special attention. Whatever its merits in an affluent society characterized by a highly competitive agricultural sector, and supplied by a massive network of supportive institutions and services, this approach begs important questions when applied to the developing countries. It provides no basis for determining the effect of predominantly traditional institutional structures upon the attitudes, perceptions, and behavior of peasants who typically constitute the overwhelming proportion of the

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population. It also provides no basis for identifying ways in which external suppliers either facilitate or hinder linkages between traditional systems and "modern" systems, as commonly represented in the developing countries by governmental agencies which design and implement development programs and are the principal source of inputs and services farmers require in order to become more productive. There is growing evidence that the major constraints to the modernization process in agriculture originate outside the narrow confines of the village and thus are beyond the control of farmers.[4]

After reviewing scores of adoption studies in the United States, and after conducting exploratory field interviews with Indian farmers in a number of villages, it was apparent that adoption studies in the United States would have only limited relevance to India.[5] Profound differences in the cultural, economic, and institutional context of agriculture, qualitatively different circumstances affecting adoption which emerge from this societal context (e.g., lack of farmer control over agricultural decisions), and observed differences even in the process itself dictated an approach more in harmony with the harsh realities of Indian agriculture.

LEVELS OF ANALYSIS

For reasons already alluded to, problems associated with cross-cultural transfer of cultural traits and technology are proving to be much more complex and difficult than imagined during the Marshall Plan era. It is the author's contention that new perspectives and approaches to adoption and diffusion research in developing countries are needed to cope with the complexity of this phenomenon.[6] In particular, greater attention will have to be paid to the suppliers of new inputs without which traditional agriculture cannot transform itself. The suppliers of these new factors in a very real sense hold the key to increased productivity and sustained economic growth in agriculture.

In the areas studies in India, it was apparent that variables affecting adoption existed at different levels. In the villages referred to in this paper,[7] variables affecting adoption were identified and analyzed at three levels--the individual farmer, the local village, and the world outside the narrow confines of the village.

These variables have been called situational, local, and external, respectively.

A. SITUATIONAL VARIABLES

Situational variables are defined in this paper as those differences among individual farmers with respect to availability of production resources (land, labor, credit, bullocks, implements, irrigation facilities, etc.) or personal and social characteristics (age, literacy level, subsistence-orientation, caste membership, etc.) which affect either the farmer's desire or ability to adopt recommended inputs and practices. Situational variables in the village studies in India,[8] were analyzed under three major categories, 1) the farm unit (size of farm, fragmentation of holdings, ownership status, land fertility), 2) production resources (capital, irrigation facilities, equipment, family labor supply, bullocks), and 3) personal characteristics (age, literacy level, subsistence orientation-value of products marketed, business orientation-keeping of farm records, and caste membership).

As might be expected, the sixty farmers interviewed differed in important ways, as did the total population of farmers in both villages, with regard to situational variables.[9] On the other hand, many characteristics were shared by a majority of farmers (e.g., 429 of 528 farmers or 81% in Amera, and 73 of 136 or 54% in Bhinori had less than five acres), and some characterized all farmers (in Amera, 4,518 separate plots were cultivated; those holdings with less than five acres averaged 3.5 plots per acre, those with 50 acres or more an average of 1.5 plots per acre). In addition, the scarcity of labor at peak periods of activity was a serious problem for all farmers, the small holders more than the large. Invariably, small farmers worked for larger farmers to the neglect of their own land.[10]

Most farmers interviewed were bhumiswamis (having full ownership rights to land), and none of the farmers in either village had any improved implements, although the need for them was voiced by many. Age bore no perceptible relationship to adoption (in Amera, larger proportions of adopters were in the middle and upper age groups while adopters in Bhinori tended to be younger). None of the farmers kept farm records, and only ten of the sixty farmers could read or write their names (defined here as literate). These included both adopters and non-adopters. Caste differences

among families in the two villages were relatively small, and caste membership played no discernible role in adoption. By the use of sociometric techniques, it was possible to identify the most progressive farmers in the two villages, as judged by their peers, and to identify the individuals chosen as well as the individual making the choice. These data are shown graphically in the accompanying sociograms; each connecting line showing the individual making the choice, and the arrow designating the person chosen. Sociograms identify the "most progressive farmers" in each village by caste (caste of farmer chosen, and of farmer making choice). (Figures 1 and 2). The caste membership of progressive farmers was in approximately the same proportion as the caste affiliation of farmers in the sample who designated the most progressive farmers.

In sum, the situational variables that were found to be positively associated with adoption, as herein defined, were size of holdings and availability of productive resources. In Amera, for example, the proportion of all cultivators who had adopted recommended practices ranging from 5.8% for holdings of less than five acres to 85.7% for farmers with 30 acres or more. In Bhinori, those ratios were 32% and 100%. (Figures 3 and 4). Also, all farmers in both villages with 10 acres or more had bullocks, while 65% in Amera and 30% in Bhinori with less than 10 acres did not.[11]

Of far greater significance, however, than the influence of situational variables per se, were government policies and practices which excluded a majority of farmers from participating in the new government agricultural program, and caused great anxiety and discontent for those who did. These were representative of the many constraints exerted by external change agents as they affected situational variables:

1. The Central Cooperative Bank in the District did not loan to farmers who owned less than three acres. (70% of families in Amera; 40% in Bhinori).

2. The Gram Sevak (village level worker) paid relatively little attention to small farmers who were ineligible for credit, most respondents reported.

3. The belief was commonly held among small farmers that the new recommended practices were meant for the big

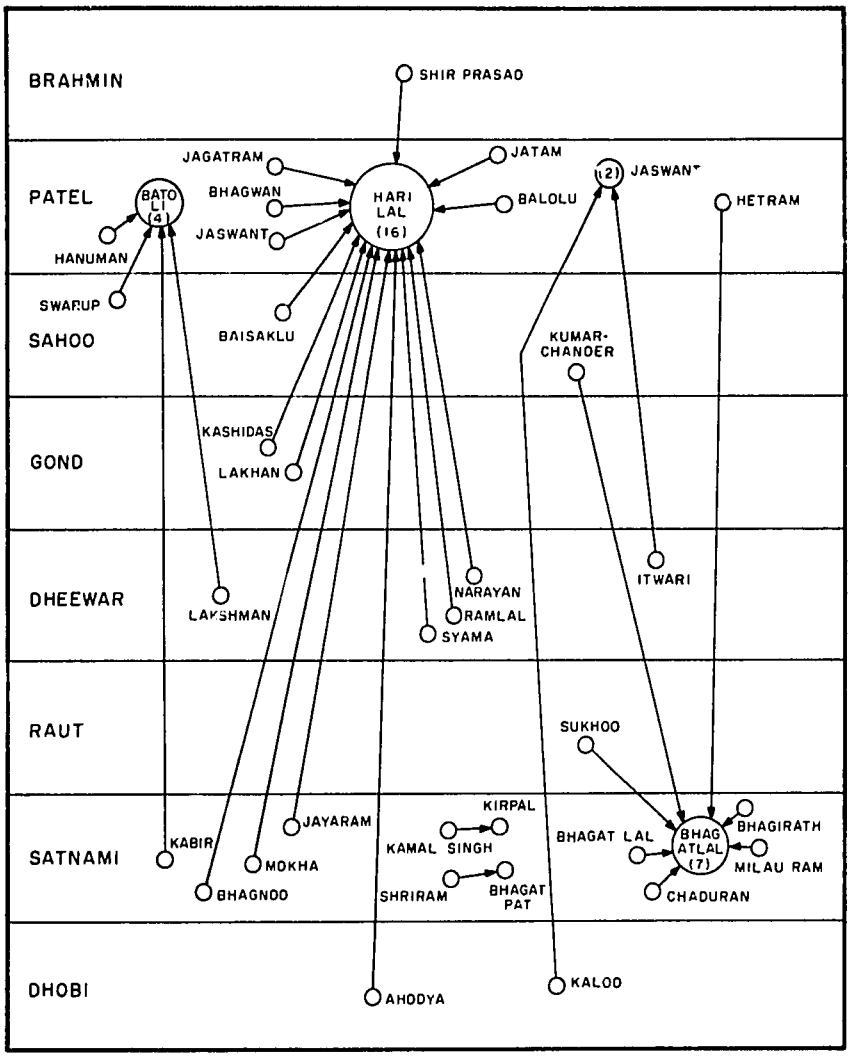

FIGURE 1. Sociogram of Most Progressive Farmers in Village A, as Stated by Thirty-Two Informants.

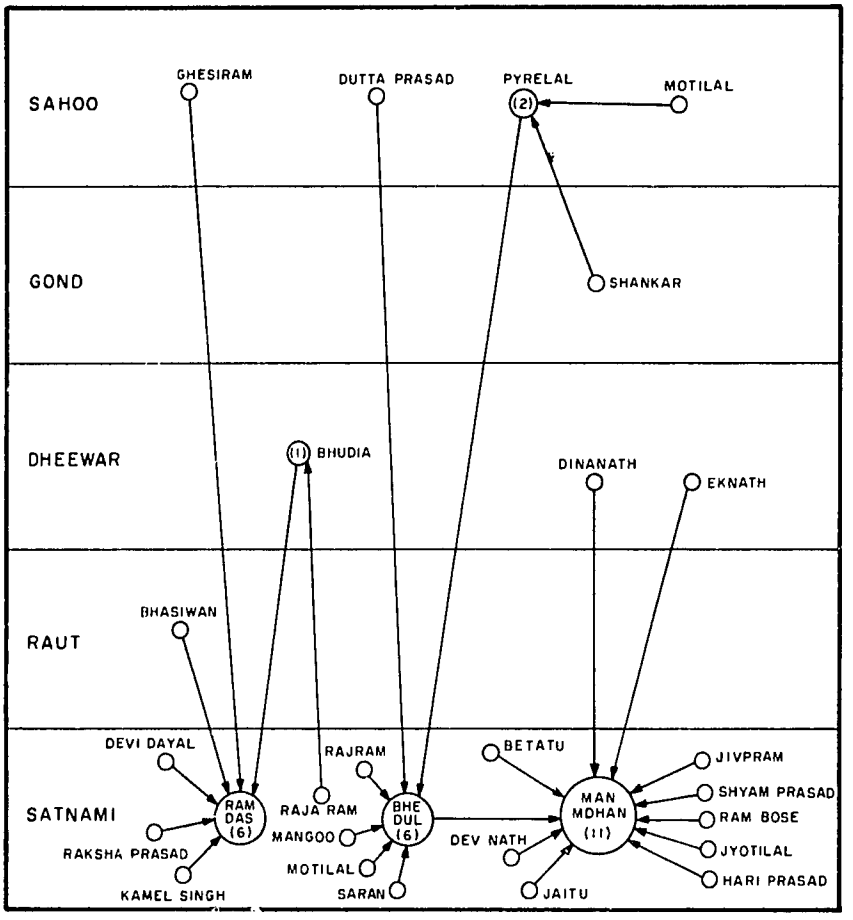

FIGURE 2. Sociogram of Most Progressive Farmers in Village B, as Stated by Twenty-Eight Informants.

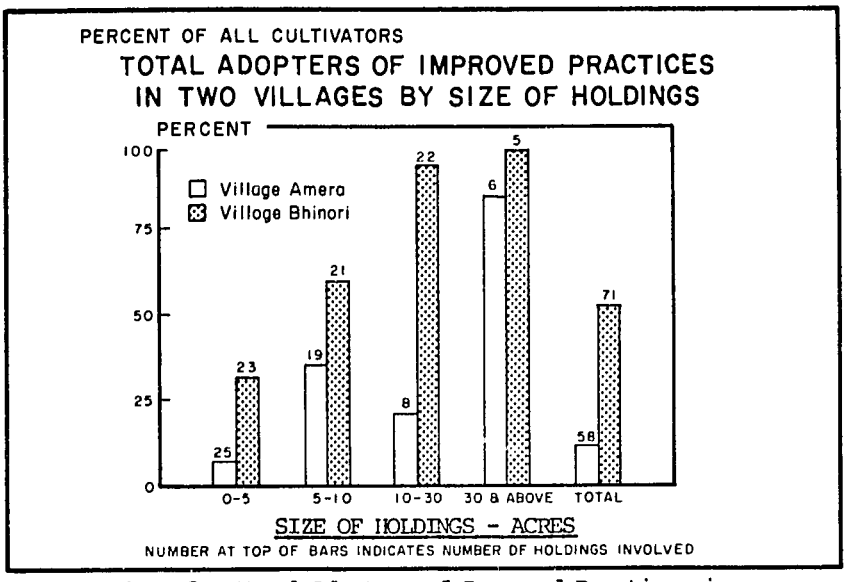

FIGURE 3. Total Adopters of Improved Practices in Amera and Bhinori, by Size of Land Holdings.

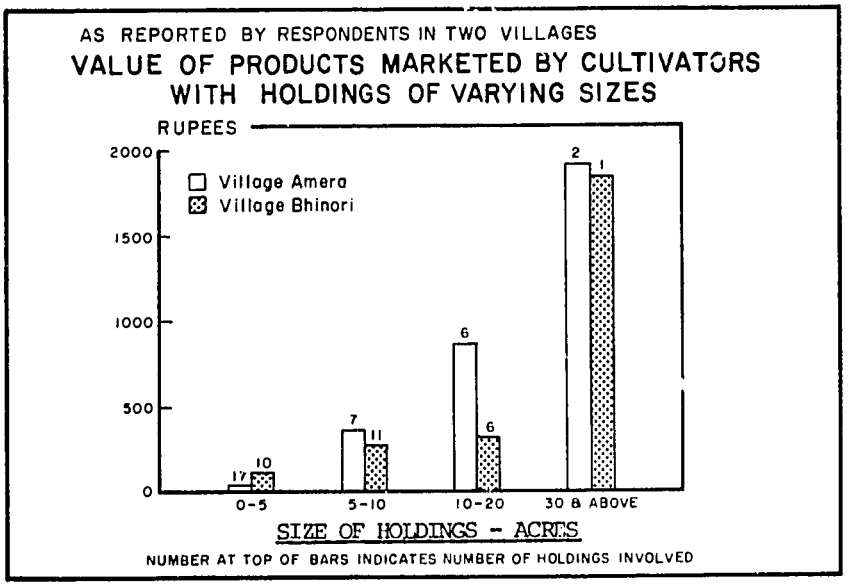

FIGURE 4. Value of Products Marketed in Amera and Bhinori by Size of Land Holdings.

farmers (result demonstrations in Amera were held on farms with 14, 16, 26, 40 and 60 acres, and in Bhinori on a farm with 37 acres).

4. Even where irrigation facilities were stated to be available, farmers interviewed reported many problems of water utilization. Farmers interviewed stated that much of the uncertainty associated with the availability of water was because they had no control over the facilities. (Control rests with the Irrigation Department of the state government). Though irrigation was meant to minimize uncertainties, respondents emphasized uncertainties and risks in utilizing it. (74% of non-adopters gave "undependable irrigation" as a reason for not adopting).

5. In summary, all farmers in the villages faced a number of serious problems, the smaller more than the larger. Nearly all farmers interviewed expressed the opinion that government policies and practices were not addressed to solving their problems, but resulted in adding a new dimension to the problems already existing.

B. LOCAL (VILLAGE) VARIABLES

Village circumstances affect in many ways the adoption of improved agricultural practices. These are key village factors affecting adoption:

1. Existing physical and geographical factors such as topography and soil type set the bounds of land-use potential beyond which village farmers cannot go without incurring risk of heavy loss.

2. Village location with respect to urban areas and the availability and quality of communication and transport facilities determine not only the accessibility and cost of supplies but also the cost of marketing farm produce. Location influences the availability of outside employment to a) provide additional sources of income, b) decrease land "hunger" in the village, and c) decrease the supply of labor to agriculture. Location is itself a factor in social change; isolated villages have less contact with the

outside world and are isolated from the potential influences for social change which these contacts entail.

3. The social structure and patterns of interpersonal relations within a village have significant implications for social change, as do the effectiveness of village leaders and village institutions. For example, dynamic village leaderships can facilitate agricultural development and community progress by encouraging community action on common village leaderships. Similarly, lack of leadership, or divisive factions within the village, can have a deleterious effect on progress.

Few discernable differences in local (village) variables were observed between Amera and Bhinori. Both were close (three and five miles, respectively) to the block headquarters, and to the nearest mandi (market for agricultural products). Both were connected by a pucca (all-weather) road, had bus service to the district, block, and tehsil (township) headquarters, and both were served by a railhead some 20 miles away. Data from the study suggest that Bhinori was somewhat better endowed with soil resources than Amera (Bhinori had 12.4% more land in paddy (rice), and 5.1% less land in teara (an inferior type of millet). With the exceptions noted, however, cropping patterns were similar in both villages.

Of greater significance than most situational factors, however, were the data on intensity of cropping (total cropped area/net cultivated area x 100). Intensity of cropping in both villages exceeded 150%, which testifies to the niggardliness of subsistence-oriented traditional agriculture where low crop yields are tolerated (and expected) because so few inputs have been expended to obtain them. Double-cropping here, informants stated, is practiced because no crop yields are abundant. The second crop is grown in spite of the small prospect of a satisfactory yield. No inputs other than seeds were used, and no cash expenditures were made in raising the second crop.

Detailed analyses were made of all aspects of village leadership, social structure, and formal organizations. The results are briefly summarized below.

Informal leaders in both villages already played an important role in spreading information to others regarding improved

practices. In Amera "fellow-cultivators" ranked first among both the adopters and non-adopters who had holdings of less than 10 acres, second among adopters with holdings of 30 acres or more. "Fellow-cultivators" (usually progressive farmers) in Bhinori generally ranked second for both adopters and non-adopters in all size groups. In Bhinori, the Gram Sewak (VLW) ranked first in all instances. (He lived in Bhinori and had good rapport with farmers).

Cultivators' responses regarding 1) the adequacy of present sources of information, 2) need for more information, and 3) most important sources of information, indicated that progressive farmers (though not officially utilized) had considerable potential for fuller utilization in extension education activities. With the exception of the VLW, other means of information dissemination had not been attempted to any significant degree. Nearly all castes in both villages had strong caste panchayats (councils). Village leadership was seldom based on cast, however, but was determined usually by economic and other factors. The role of village leaders in the adoption of practices was negligible.

Formal village organizations included service cooperative societies, village panchayats, village volunteer forces, youth clubs, Mahila Mandals (womens' society, in Amera only), schools, etc. Each village had a service cooperative society. Both societies were affiliated with the block-level marketing society, through which members were required to market their produce. Farmers reported that they had little voice in determining cooperative policy. Their responses indicated that the cooperative acted chiefly as an instrument of government policy and was mainly concerned with meeting government targets rather than dealing with the felt needs of cultivators.

Amera and Bhinori each had a panchayat, with 18 and 9 members respectively. The method of election was by the raising of hands. Theoretically, the panchayats were supposed to have the following committees: agriculture, education, construction, and irrigation. Strangely, however, none of the sixty informants, including some whose names appeared on the committees, was aware of the existence of any committee charged with specific responsibility in agriculture, and no informant reported being a member of such a committee. The role of village panchayats in

promoting agricultural activities was imperceptible, as were those of other village organizations.

Each village had a school. Attendance had declined in both schools in recent years, however. Villagers attributed the decline to a deteriorating economic situation in their villages, together with the increasing population. The population rise, they stated, placed a heavier responsibility upon each family member to work and contribute to the family income. Villagers expressed the opinion that the use of child labor had increased, resulting in lower school attendance.

The role of local (village) variables may be summarized as follows:

1. Intensity of cropping, informants reported, was necessary because of difficult agricultural conditions in the villages, and was reflected in low yields.

2. Village organizations--panchayats, youth clubs, schools--had played no perceptible role in agricultural activities or in adoption of new practices.

3. Informal leaders (progressive farmers) hold great potential for influencing other farmers to adopt new practices, but were not formally utilized.

4. Informants stated that they had no voice in cooperative policy. The cooperative was mainly concerned with meeting government targets rather than meeting their felt needs, thus providing no opportunity for development of local leadership and institutions essential to development.

C. EXTERNAL VARIABLES: THE ROLE OF INFLUENCES FROM OUTSIDE THE VILLAGE

Nearly all material inputs available to farmers in Amera and Bhinori were supplied by government agencies. The sixty farmers interviewed, adopters and non-adopters alike, expressed much dissatisfaction with the suitability and quality of the material inputs, and the conditions under which they were made available. Specific reasons for dissatisfaction with material inputs may be found in the

original study. Space permits reference to only a few: information, input supplies, and services.

One-third of the farmers interviewed said that information was either "inadequate" or "very inadequate." Many said they could not understand it, or that it was not relevant to their needs. While one-third (21 of 60) indicated they needed more information, the two-thirds said they did not. It was clear from the replies of the latter group, however, that "more information" had reference to the unsatisfactory type of information they had already received. In Amera, all adopters and a majority of non-adopters reported they were not favorably impressed by result demonstrations conducted in the village. In Bhinori 53% of the adopters and 40% of the non-adopters likewise reported that field demonstrations were not convincing.

None of the farmers interviewed had any improved implements. Both small and large farmers in the sample group, however, expressed the view that improved implements could play a large role in permitting farmers to adopt new practices. Currently, cultural practices in these villages are very labor intensive, resulting in acute shortages of labor at peak periods of activity. Implements to meet seasonal shortages of labor would prove most beneficial.

The strong displeasure over dhaincha, (the recommended green manure crop) was uniform among all farmers interviewed. Four of five users in Amera, and 10 of 13 in Bhinori questioned its usefulness and complained about problems encountered in growing it. With ammonium sulphate and super-phosphate, displeasure also was strong (11 of 12 users in Amera, and 10 of 20 users in Bhinori). Most farmers preferred urea, but were not able to get it. Dissatisfaction with other supplies was expressed by nearly all farmers interviewed.

Services provided by government agencies included credit, information, material inputs and marketing. Here again, much displeasure was expressed concerning the quality, content, and terms under which services were provided. These were key complaints:

1. The Central Cooperative Bank in the district did not loan to farmers who owned less than three acres.

2. For those receiving credit, supplies were compulsorily linked with credit. Also, those receiving credit were required to market their produce through the government marketing society at depressed harvest-time prices, causing substantial losses in income.

3. Farmers interviewed expressed great concern over availability of, and control over, irrigation water exercised by the Irrigation Department of the state government.

4. Rigid loan recovery policies of the primary cooperative society after bad crop seasons left many borrowers bitter, frustrated, and despondent.

In summary, the supplies and services provided by external agents were deemed as unsatisfactory, both in terms of quality and appropriateness. Additionally, the conditions under which they were made available were considered by most informants to be inappropriate to their difficult circumstances and not in accordance with their needs.

THE MODERNIZATION PROCESS: SEARCH FOR CAUSES, CONDITIONS, AND PROCESSES

Increasingly, observers of the modernization process are recognizing that the development of a society involves a restructuring of relationships between governments and people in such a way that the mass of people in a society have access to the means of production, to credit, to the market, to technical knowledge, and to the national economic, political, and social systems. Even substantial increases in the gross national products of developing countries will neither relieve poverty nor improve the lot of the average man unless the political decision is made to give this access.

Owens and Shaw make a formidable case for a new kind of development that goes to the heart of any economy--its people. Although they argue that jobs are very important, since they create purchasing power and raise the lot of the average man, they say that something else comes even before jobs. And that is the organization of a country so that 1) the proper decisions are made at the right levels of government, 2) as many people as possible are

involved in decisions that affect their own lives, and 3) effective links between the different levels of decision making are enforced. In short, "The creation and diffusion of sufficient political power to enable governments to govern is the great political problem of development".[12]

Owens and Shaw divide the Third World into what they call "modernizing" and "dual" societies. By dual they mean a society that is still essentially split into a group who does the ruling and a group who rules. This is not a Democratic vs. Communist split, they argue, but rather a question of how the power is really exercised in any society. Modernizing societies are those which are learning to share decision making and thus to develop linkages between the various levels of society. Taiwan is cited as the prime example of a society that is successfully modernizing, while Mexico and India, even though democracies, are rated as dual-type societies, since the authors fail to find the necessary input into decision making at the local level. This author's own research in India, summarized in the preceding pages, supports the same conclusion.

THE ROLE OF SMALL FARMS AND SMALL-TOWN INDUSTRY

The cities throughout the Third World have shown themselves incapable of putting to work the landless peasants who migrate to urban areas. The spread of urban slums throughout the world demonstrates that the type of capital-intensive development taking place in the cities does not alone generate enough new jobs to ease the plight of either the urban or rural masses.

Having established that the organization of a society is of crucial importance, and that decision making must be widely diffused, Owens and Shaw then go on to argue that the emphasis must be on developing small farms and small-town industry. An increasing amount of development literature presents the same argument, including the author's own research in India.

What, then, can be the role of small farms and small-town industry in the modernization process? For a partial answer to this question, let us return to the village studies in India.

Social change requires the introduction of "change material" into a society by the presentation of alternative ideas, practices, or choices to change or to supplement existing ones. Information and the communication sources, channels, media, and methods by which it is brought to the farmers are of crucial importance in facilitating wide adoption of scientific practices, as well as in fostering the new attitudes involved in change. Information alone is not sufficient, however. Once a farmer is convinced that he can improve his lot, he must then be able to acquire the necessary inputs to enable him to carry out in practice what he has already accepted in principle.

Development agencies seeking to advance adoption of improved practices must provide certain essentials if their suggestions are to gain wide acceptance. These essentials include a) an atmosphere of mutual respect and trust between "change agents" and the farmers, b) reliance on sound and tested extension principles and methods to strengthen the educational process and to broaden cultivator's goodwill and support; c) emphasis on inputs and practices that are highly visible and profitable, d) focus upon the felt needs, feelings, and aspirations of farmers, e) provision of information to adequately explain the desired practices and motivate farmers to action, and f) development of local leaders and organizations through which the human resources of the villages can be effectively mobilized.

Adoption of a new farm practice requires that the cultivators be made aware of the practice, become interested in it, evaluate it, try it out, and then take the step of adoption. At least the first three of these steps depend upon the flow of information to the cultivator: without this flow, adoption cannot occur.

Adoption is thus the result of the interaction between two variables, receptivity to new ideas (Information Potential) and ability to carry out these ideas in practice (Action Potential). These two variables provide us with the conceptual tools to classify the four basic categories of farmers living in these villages. The Information-Action Potentials of these four types, and the Present Characteristics of each category at the time this study was made are presented in Table 1.

Table 1. Information Potential, Action Potential, and Present Characteristics of Four Basic Categories of Farmers in Amera and Bhinori

Category	Information Potential	Action Potential	Present Characteristics: Personal Characteristics	Present Characteristics: Farm Characteristics	Present Characteristics: Adoption Characteristics
I	+	+	Progressive	Viable	Adopters
II	+	-	Potentially progressive	Non-Viable	Potential adopters
III	-	+	Traditional	Viable	Potential adopters
IV	-	-	Traditional	Non-Viable	Non-Adopters

CATEGORY I

Category I includes those farmers who now have adequate credit and other resources and produce the bulk of the marketed surplus of food. They will probably continue to do so for some time to come, in spite of the fact that the policies and practices of external suppliers of the new inputs and services are often ill-attuned to their difficult circumstances and needs. Generally, they are progressive cultivators who have either already adopted many improved practices or are receptive to useful information which could help them to be even more productive. By definition, they have the most viable production units, defined as one that is capable of producing enough to support an average cultivator family, at least on a minimum level, taking into account existing agricultural and marketing conditions in the area, present levels of productivity, prices, costs, etc. Such cultivators are only a small fraction (5-10%) of the total in the villages but operate about 30% of the cultivated land. Their relative importance as a source of increased production and marketings is manifestly large.

Cultivators in this category indicated they had basic need for:

1. information on the use of more advanced practices than are now recommended,

2. wider and more effective channels for supplies and services,

3. supplies and services more appropriate to their needs.

Several indicated that the policies of the local cooperative are not well oriented to the needs of this group. One of the largest and most influential farmers in the two villages, long a cooperative member, quit the society recently, stating that he lost money by having to sell to the cooperative at harvest time at prices lower than offered by private traders. Fully functional farmer-oriented cooperatives could contribute significantly to the adoption and spread of more productive practices, to the benefit of all farmers.

CATEGORY II

The second group, farmers who are desirous of change but who have marginal viable units under present conditions, would benefit by adopting desirable practices, but are seriously handicapped in doing it. Many cultivators in this group already produce for the market. Their potential for accepting useful information and for increasing production would be substantial under more favorable credit, supply, and service conditions. Farmers in this category appear to have three major needs:

1. a little more land to establish more viable units,

2. more and frequent information oriented to their specific needs,

3. necessary credit, supplies, and services under more favorable terms.

Farmers in this category include up to 20 to 25 per cent of the cultivators in these villages.

CATEGORY III

The third category of cultivators in the two villages is small in number, but has importance because of the relatively viable production units involved. In this group are the few who rent out land

to others. They now make no long-range improvements on leased-out land, invest little in its cultivation, and sponsor none of the costlier improved practices. The potential of much of their rented-out land is generally low, but the portion of their holdings which they cultivate is often productive land where investment in additional inputs can be rewarding. Cultivators in this category constitute about 5% of the farmers in the villages studied but control a substantially higher proportion of land.

CATEGORY IV

The remaining category includes the farmers whose holdings have such a small capacity for production under existing conditions that they cannot provide even minimum-level support for a family at present levels of productivity. Some of these units may be relatively large in size, but have poorly-drained land or other serious handicaps; many of them have relatively good land, but are too small to afford any market production potential--a necessary base for credit. These are shown in Table 1 as non-viable units. They are operated by tradition-minded cultivators, non-adopters of new practices. The holdings included are basically subsistence units, supplying little marketable surplus. Though their market production potential is relatively small, they have great aggregate importance. This group includes about three-fourths of the farmers in the villages studied, accounting for about 25% of the cultivated area. Cooperative credit and services are inaccessible to most of these farmers under present conditions. They ordinarily receive little attention from extension workers, and have restricted access to information regarding improved practices. All these factors inhibit their adoption of new practices and thus their output.

THE WIDENING GAP

Several conclusions may be drawn from the data presented here:

1. External constraints represent formidable obstacles to the adoption of new inputs and practices in the villages studied in India.

2. Nearly all farmers expressed dissatisfaction with the appropriateness and quality of inputs and services and with the conditions under which they were made available.

3. Two-thirds of the farmers in the villages studied were precluded from participation in the new agricultural program.

4. In spite of the general dissatisfaction with the external supplier (government), one group of farmers (Category I) adopted new inputs and increased their productivity. The number of adopters of improved practices and the value of products marketed were in direct proportion to size of holdings (Figures 3 and 4).

5. As a consequence of governmental policy, the gap between the larger and wealthier farmers and the smaller farmers continues to widen.

Ladejinsky has observed that "most of them (Indian farmers) need no persuasion that modernization, which stands for bigger crops and higher income, is good for them. Waiting to be a part of it and not getting there create potentially disturbing social, economic, and political issues. And this is the other side of the coin in any assessment of the green revolution . . . The 'green revolution,' affects the few rather than the many not only because of environmental conditions but because the majority of the farmers lack resources or are 'institutionally' precluded from taking advantage of the new agricultural trends."[13]

EXPLOITING THE POTENTIAL: LESSONS OF EXPERIENCE

It should be emphasized that the above categories of farmers in Amera and Bhinori were delineated on the difficult conditions actually pertaining at the time the study was conducted. They do not necessarily reflect the real potential of these farmers to respond to the "green revolution" when appropriate inputs and services are provided by external suppliers under conditions more appropriate to their circumstances and needs. The real potential of farmers in any of the categories was difficult to assess at the time of the survey, since virtually all farmers were of the opinion that the

inputs and services provided by government agencies were ill-suited to their circumstances and needs.

A growing crisis in development progress is threatening the survival of many governments in Asia, Africa, and Latin America, according to Grant. Although acknowledging the severity and complexity of problems facing Third World countries, Grant suggests that many of these problems persist because of the lack of appropriate government policies. Many of the lessons of experience--particularly the success of Taiwan (in the rural areas) and Singapore (urban areas)--could do much to alleviate the kinds of problems faced by farmers in Amera and Bhinori, and indeed in most developing countries. On the other hand, many policies taken for granted for so long have not been able to cope with the problems of these countries, according to Grant. Among these are the following:

1. The substantial achievements of a development strategy dominated by economic growth--fall dangerously short of meeting development needs. (Unemployment levels continue to increase, the income gap continues to widen between the masses and the relatively well off, and their population explosions continue to present vexing problems).

2. Rural development has been neglected, but must be actively pursued (including land reform in many cases) since two-thirds of the people in poor countries live in rural areas.

3. Poor countries need to reduce the persistent imbalance in the prices of capital, labor and foreign exchange which favor the use of equipment rather than labor, and encourage industries that make use of available labor; their most plentiful resource.[14]

On the positive side, Grant cites a number of policies that have been successful in reducing unemployment, increasing savings and investment, promoting productivity and well-being of rural people, and narrowing the gap between the rich and the poor within their societies. These include, for example, such matters as land reform, rural credit, financial policies favoring use of labor over machines, and the provision of effective low-cost education and health services to most of the population. There is no reason to

believe that similar policies could not go a long way toward alleviating the plight of millions of small farmers in villages like Amera and Bhinori.

THE EAST ASIAN EXPERIENCE

Taiwanese farmers with relatively small holdings have been confounding traditional economic analysis, Grant declares.[15] They have shown a high propensity to save and invest out of their small incomes whenever it is clearly profitable for them to do so. As a result, the average householder has more than trebled his real income since 1950. Significantly, this progress has not resulted from taxes based on the urban and industrial sectors, but has been paid for mainly out of land reform and the farmers' own increased production. Not to be overlooked is the crucial role of multi-purpose farmer associations: the cooperative associations are run by and for farmers, they are the primary source of credit, supplies and technical advice, and provide farmers with a major marketing outlet.

The East Asian experience, Grant concludes, thus provides heartening lessons: 1) "that a development strategy that provides social justice through making it possible for a farmer . . . to work more effectively for his own advancement can actually accelerate growth," and 2)". . . that it may now be possible to attack several problems simultaneously. For example, a comprehensive land reform program, backed up by an effective credit system, simultaneously increases savings, output, farm employment, and demand for labor-intensive products, while improving distribution and attitudes toward family planning."[16]

SUMMARY AND CONCLUSIONS

This paper presents data obtained through in-depth interviews with a sample group of 60 cultivators in two villages of one district in Madhya Pradesh, India. Though the data are for two villages, many of the conditions affecting adoption of recommended practices in these villages apply to broad areas of rural India. Therefore, the conditions described have important implications for the nation's efforts to increase agricultural output and improve village life.

The factors affecting adoption in the villages studied were identified and analyzed at three levels--the individual farmer, the local village, and influences originating in the world outside the narrow confines of the village. These have been called situational, local and external variables, respectively. This approach was necessary because of the widely different conditions prevailing in India as compared to the more highly developed countries, particularly the United States, where most adoption studies have been conducted.

Important situational factors affecting adoption include size and fragmentation of land holdings, dearth of production resources--bullocks, carts, implements, family labor, and other factors. Personal and social characteristics of farmers (age, caste membership, etc.) play a relatively minor role in adoption in these villages, apparently because of the overwhelming importance of economic and other factors at the present stage of agricultural development, and the authoritarian and arbitrary policies of external suppliers of virtually all new inputs. At the local level, formal and informal leaders in these villages play an imperceptible role in encouraging adoption. The authoritarian and target-oriented nature of the agricultural programs has precluded effective local organization for agricultural activities. External factors have many important, indeed crucial, influences on adoption of new agricultural practices in the villages studied. The more important of these influences are summarized below.

The need for further institutional orientation of external agricultural agencies to the problems and difficult circumstances of local cultivators was evident. Cooperative services and extension educational programs were reported as concerned mostly with meeting official targets and performing pre-determined operations. Farmers reported that they had no voice in cooperative associations or in agricultural policies. The approach of meeting the felt needs of cultivators requires further emphasis if adoption of new inputs is to become widespread.

Influences retarding adoption of recommended practices included various dissatisfactions regarding prices, cultivators' experience with rigid loan recovery policies after bad crop seasons, compulsory linking of credit with supplies and marketing, their lack of understanding or approval of certain of the recommended practices, lack of adequate demonstration and explanation of new

techniques, unsuitability and unprofitability of some of the recommended practices under local conditions, and government policies that precluded two-thirds of all farmers from participation in the new agricultural program. In the villages studied, credit and production supplies were revealed as prerequisites for enabling and encouraging adoption of recommended production practices. The improved practices involve use of purchased production supplies, available only on credit from the local cooperative. The cultivators interviewed in this study reported that credit was essential for adoption, and was even a primary cause of adoption. However, about two-thirds of all cultivators in these villages were automatically ineligible for cooperative credit, since the local cooperative credit structure did not provide for loans to farmers with holdings of three acres or less.

A desire for higher productivity and incomes was reflected in the comments of all cultivators interviewed, refuting a commonly held doctrine that farmers in Third World countries are not responsive to normal economic incentives. Their attitude holds great potential for future improvement in production, if means could be found for overcoming the present difficulties. The problems outlined in the report are restricting the possibilities of increasing agricultural output, of raising incomes and living levels, of inspiring a spirit of change among the people, and of achieving the nation's goal of self sufficiency in agricultural commodities.

FOOTNOTES

[1]The original study on which this paper is based was conducted while the author was employed by the Ford Foundation (India Field Office) as a consultant in Community Development from July 1962 to June 1964. Grateful acknowledgement is hereby made to the Ford Foundation, to Dr. Douglas Ensminger, its Representative in India, and to the National Ministry of Community Development, GOI, for making this research possible and for publishing the findings in India.

[2]Linwood L. Hodgdon and Harpal, Singh, Adoption of Agricultural Practices in Madhya Pradesh (India), (Rajendranagar, Hyderabad-30, A. P., National Institute of Community Development, Government of India, 1966).

[3]"Adoption" as used here is less inclusive than "diffusion" and refers to the stages of the diffusion process as commonly viewed by American researchers--awareness, interest, evaluation, trial, and adoption, usually of a single idea of material trait. The diffusion process has been defined as 1) the acceptance, 2) over time, 3) of some specific item--an idea or practice, 4) by individuals, groups or other adopting units, linked to 5) specific channels of communication, 6) to a social structure, and 7) to a given scheme of values (culture). [The latter definition from Elihu Katz, Martin Levin, and Herbert Hamilton, "Traditions of Research on the Diffusion of Innovation," American Sociological Review 28 (April 1963), 237-252].

[4]For example, the main thesis of Edgar Owens and Robert Shaw in Development Reconsidered, (Lexington, Massachusetts: Lexington Books, 1972) is that farmers are not involved in the decisions that affect them nor do they have access to the money, skills, and information needed to take advantage of local resources. They also lack access to their own national economic and political social systems so essential for development.

[5]Most adoption studies have assumed that farmers adopt new practices because of personal conviction. Other factors were involved in these villages; however, adoption of improved practices and membership in the government cooperative society were virtually inseparable. Moreover, the "package of practices" was

compulsorily linked with credit, supplies and marketing. In many instances cultivators became members and accepted credit not because of conviction but because of their desperate need for credit. Alternative sources of credit were severely limited and very costly. Ideally, an "adopter" would be one who follows all the recommended practices, however, none of the sixty farmers interviewed did this. Consequently, an adopter as defined in this study is 1) a farmer who joined the government cooperative society, thus accepting the compulsory linking of credit, supplies, and marketing, and 2) a farmer who used one or more of the inputs or practices in the "package of practices" (commercial fertilizer, green manure, pesticides), either as recommended or in a somewhat diluted manner. The practice of dilution was common, and was motivated by the shortage of capital resources, the desire to minimize the risk of crop failure by hedging (spreading fertilizer over a larger area than recommended), the desire not to put expensive non-traditional inputs on leased land that may be leased to another cultivator the following year, and other considerations.

[6]For a more comprehensive discussion of this topic, see Linwood L. Hodgdon, New Perspectives in Diffusion Research in Developing Countries, paper read at the annual meeting of the Rural Sociological Society, Denver, Colorado (August 17-19, 1971).

[7]The two villages included in the study were in Raipur District of Madhya Pradesh, one of the districts included in the Intensive Agricultural District Program of the GOI, and supported by the Ford Foundation. Village names are fictitious in order to preserve the identity of informants. New or non-traditional practices recommended in the "package of practices" included application of inorganic fertilizer, use of a green manure crop, use of pesticides, and use of the Japanese method of rice cultivation (optional, used by only four or five farmers). Traditional practices included application of tank silt, organic manure (compost--since cattle manure is used primarily for fuel), raising and repairing of bunds, leveling of fields, "balbaisi" (thinning of plants four weeks from sowing), planting shrubs on boundary bunds, weeding, thinning, and irrigation.

[8]The villages chosen were in an area in which adoption of recommended practices was progressing reasonably well and where cooperation from officials would be assured. It also seemed desirable to choose an area with a reasonably diverse cropping pattern,

and in which a Hindi-speaking researcher from the National Institute of Community Development and his assistant could interview informants directly, without use of an interpreter. The two villages selected were located in an area where the specific practices recommended to farmers were clearly identified, thus the adoption or non-adoption of these practices could be studied with greater precision.

[9]Methodologically, it was advantageous to study adoption in two similar villages, preferably close together, in order to eliminate as many variables as possible (different village level workers (VLW's), different extension specialists, differential accessibility to supplies, services, market, etc.). The villages selected were three miles apart, were served by the same Gram Sevak (VLW) and extension specialists, utilized the same market facility, had similar types of soil and cropping patterns, and divergent rates of adoption of the recommended practices (52.2% and 11.0% respectively).

The sample group of 60 cultivators were selected at random from a list of all cultivators in the two villages, weighted by the proportion of adopters in the total. This procedure resulted in a total sample of 60 cultivators, 32 from Amera (9 adopters and 23 non-adopters), and 28 from Bhinori (17 adopters and 11 non-adopters).

[10]The data from this study do not support the doctrine of labor of zero marginal productivity; namely, the concept of workers in agriculture who contribute nothing to production and thus are available for other purposes such as industrialization at no cost except that of transfer. Acute labor shortages existed in these villages, particularly at peak periods of activity such as planting and harvesting. This affected small farmers very adversely, as they were required by custom and necessity to work for larger farmers to the neglect of their own holdings. For a detailed analysis of this concept, see Theodore W. Shultz, Transforming Traditional Agriculture, (New Haven, Yale University Press, 1964), pp. 53-70.

[11]Ten acres is commonly considered a "bullock unit," but nearly three fourths of the farmers had less than that.

[12]Richard Henneman, "When Aid Doesn't Work in the Third World," Christian Science Monitor, (January 25, 1973), p. 9, quoting Owens and Shaw's Development Reconsidered.

[13] Wolf Ladejinsky, "Ironies of India's Green Revolution," Foreign Affairs (July 1970), 758-768.

[14] James P. Grant, "Accelerating Progress Through Social Justice," International Development Review, (1972-73), pp. 2-9.

[15] Ibid., p. 7.

[16] Ibid., pp. 7-8.

Chapter VI
Credit for Small Farmers

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Agriculture is the major economic sector of virtually all less-developed countries (LDC's). Small farms usually dominate the agricultural sectors of those economies, at least in numbers if not in food production. Thus, the role of agriculture, and of small producers in particular, in economic development is of major concern to policy makers and to developmental specialists. Since the small farm sector includes the largest segment of the population, the responses of small farmers to economic stimuli are especially relevant for economic and social development.

Technological innovations for increasing productivity on small-scale farms are accepted now by most developmental specialists as being essential. Even so, the most appropriate procedure for introducing new technology to the small farmer is not always evident. A review of existing small farmer programs will bring to light a multitude of institutional, organizational, financial, administrative, leadership, political, cultural, and other problems of implementation. Some of these problems are discussed in other articles in this book. The problems directly related to the financial, or more specifically, credit area will be discussed in this article.

Agricultural credit has been viewed as an important ingredient for most small farmer development programs around the world. Indeed, in some programs credit is the major focus of such developmental efforts. Thus, credit has assumed a significant role in small farmer development, even if it has not been clearly demonstrated that credit can, or should, play such a role. The purpose of this paper is to evaluate and discuss the role of credit in small farmer development.

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HISTORICAL PERSPECTIVES

During the period from 1950 to 1972, the Agency for International Development (AID) allocated $290 million dollars, $415 million equivalent of local currencies, and 870 technical man years for farm credit programs around the world. The annual flow for this purpose has been around $54 million.[1] A large proportion of this investment went to Latin America.

The World Bank Group has also placed considerable emphasis on agricultural credit, much of it for small farmers.[2] The 1973 World Bank/IDA Annual Report shows that lending to agriculture has increased from $56 million through 1963 to $2,589 million for the period 1969-73. At least 10 percent of this agricultural lending has been specifically allocated for agricultural credit programs. In 1973, over $90 million was earmarked for agricultural credit, and a much larger sum was allocated for integrated rural development projects which included credit.

There is also a trend indicating preferential lending by the World Bank for programs aimed at small farmers. Between 1969 and 1972, the proportion of agriculture projects in which some participating farmers owned less than five hectares of land rose from 17 percent to 50 percent. On the other hand, the proportion of projects in which participating farmers had over 100 hectares has declined from 27 percent to 21 percent.[3]

In addition to the large sums for credit provided by the international lending agencies, large sums of local currencies have been budgeted for agricultural credit. For example, in India alone, the total amount of short- and medium-term credit advanced by cooperative credit societies in 1969-70 was over $744 million (5,420 million rupees).

Thus, heavy emphasis has been placed on agricultural credit for developing the agricultural sector in LDC's, both by the international lending agencies and by the countries themselves, as evidenced by the allocation of public funds. Is such an emphasis warranted and what has been the experience of agricultural credit programs to date?

THE ROLE OF CREDIT FOR SMALL FARMERS

A recent world-wide review of small farmer credit by AID has raised many questions about the correct role of credit in small farmer development programs.[4] It was generally concluded that credit is necessary in the long-term process of capital formation on small farms but that an infusion of new credit is not always needed nor will it necessarily be beneficial in the short-run. The conditions under which the credit can successfully affect small farmer productivity were found to be more restrictive than generally assumed.

All programs attempt to help the small farmers economically. However, their economic well-being can be improved with credit in three different ways: 1) direct income transfers through debt forgiveness or subsidized interest rates (welfare), 2) augmenting his supply of credit for consumption purposes (consumption credit), and 3) helping the farmer increase his production and income earning potential (production credit).

It would appear that many programs in the past have assumed small scale units to be uneconomical and, therefore, no increase in production was really expected in response to the provision of credit. In essence, the credit was looked upon as an income transfer to the rural poor. The feeling that small farms are not economically viable permeates most small farmer programs, and often leads to policies that ensure that such units will not be viable. If efficiency is measured by the value added (output) divided by the social opportunity costs of the production factors, it is not at all obvious that the smaller units are less efficient than the larger ones in the developing countries. If it can be shown that small units are as productive (except for labor) as larger units (or more productive) in the use of scarce resources, then there is no need to use credit as an income transfer to the rural poor. Using credit for income transfers may seriously misallocate scarce capital and, further, does nothing but perpetuate poverty in the rural areas. This is not to say that governments should not establish welfare programs--they are usually needed and justified. But it does question using credit as the mechanism for such a transfer.

Consumption credit poses a more difficult problem since it cannot be separated easily from production credit. Credit provided ostensibly for productive purposes can replace the farmer's

capital which in turn could be used for consumptive purposes. This is especially true for subsistence type agriculture where the farm business is an integral part of the family and vice versa. Given the fact that the two types of credit are really inseparable under small farm conditions, in the rest of the discussion production credit will be understood to mean production credit which has provided for, or at least considered, the consumptive needs of the family during the production period.

Credit, then, should be extended on the basis of its potential for increasing farm incomes. Consequently, the primary objective of a credit program should be to help the farmer increase the value of output more than the increases in the input costs, leaving him with a net gain. A net gain allows loan repayment and permits increased family consumption or capital formation. But loan repayment rates are disappointingly low, varying from less than 50 percent to 90 percent, for most small farmer credit programs in LDC's. Why has repayment been so low?

Small farmers face many important constraints when attempting to use agricultural credit. Their farms are small and often fragmented. Little potential exists for land expansion where small farmers are located without the possibility of off-farm migration. Land reform is needed in many countries, but even if it were executed, a significant population shift away from the small holding areas to the areas where larger sized units are located would be necessary. The land which small farmers do possess is often of poor soil quality and with limited access to irrigation water. Land tenure rights often are not officially recorded and are thus insecure.

Furthermore, small farmers usually have little or no access to off-farm services--new technology often does not reach the small farmer, or if so, it is in a form which he cannot use; marketing of products is difficult and local prices are highly sensitive to changes in supply; non-farm inputs are unavailable in the small sized units required or their costs are high; and little technical assistance is provided the small farmer to help him adopt new practices.

Thus, the small farmer must simultaneously solve many problems related to his limited resources--small cash flows, family consumption needs, production requirements, and unpredicted

adversities. The interaction of these variables is especially significant for the small farmer. Cash flow problems arise from the deficits and surpluses inherent in the production cycles. Crop inventories to meet food requirements of the household are as important as providing cash to meet farm operating expenses or to pay off any loans. A limited net worth and a restricted loan repayment capacity, due to small cash flows, limit the farmer's access to credit. All of these limitations have profound consequences for the small farmer when making production, marketing, and consumption decisions.[5]

The role that credit can play, then, is severely restricted by the specific conditions under which the farmer operates. These conditions will also partially explain the low rates of repayment experienced world-wide. One limitation, lack of appropriate small farmer technology, is especially related to poor loan repayment.

PROFITABLE INVESTMENT OPPORTUNITIES[6]

Credit is normally used synonymously with borrowing and both connote that the transfer of funds from the lender to the borrower is temporary. Loan repayment is assumed. Small farmers consistently have delinquent loans which means either they can repay the loans but do not want to repay them (the income is used for more pressing needs) or that they are unable to repay the loan when it comes due without placing themselves in a worse condition compared with their status before the loan was obtained. If profitable investment opportunities are not available to the small farmer, then the second assumption is the more likely cause of poor repayment.

To date, it has been widely held that credit was the limiting factor in small farmer development; thus large sums for agricultural credit have been allocated for that purpose. It was assumed that once the farmer had capital he could take advantage of existing investment opportunities. This belief has not been borne out with experience.

It is now generally accepted that most farm operators in less-developed countries operate in a rational economic manner. This implies that farm production cannot be significantly increased by either reallocating the given resources or by adding more of the

traditional inputs. A number of studies confirm this conclusion. For example, Eckert concluded that Pakistani farmers had achieved economic optimum levels of nitrogen use for native wheat varieties.[7] Thus, little opportunity existed for additional investment utilizing the existing technology. Studies in Brazil also showed it was not profitable to fertilize many existing crops.[8] This is primarily due to the very low production functions that exist for traditional practices.

A number of specialists suggest that technologies are available and that additional credit will allow farmers to put them to use. For example, Bethke concluded, after reviewing a number of agricultural credit programs in Latin America, that credit programs have overemphasized increasing yields at the expense of identifying other means for increasing farmer incomes--land expansion, diversification, and increasing labor productivity, rather than land productivity.[9] Thus, controversy still exists as to whether or not small farmers are doing a good job of allocating their resources, given the technological possibilities, factor costs, and product-price relationships which they face.

Unfortunately, few data are available concerning the profitability of expanding the use of traditional inputs. However, the data which do exist tend to support Schultz's original thesis that it is unprofitable to further expand the use of the traditional technology. It does appear that few profitable investment opportunities are available for small farmers when applying existing technology. The additional returns from the investments do not cover the additional costs. This conclusion, then, forces us to turn to the introduction of new technology if we expect to increase incomes in the small farm sector.

Most credit programs have assumed that new technology was available or at least could be made readily available to the small farmer if desired. Therefore, their main concern was getting the credit to the farmer. A few programs assumed otherwise and placed heavy emphasis on developing appropriate new technologies for small farmers and assuring that they were made available with the credit.

To assume that new technology is available for the small farmer and that it is profitable is the major error committed by the proponents of agricultural credit. If technical assistance is not

provided with credit, this either assumes such assistance is available through a sister agency, that the technology is already known and accepted at the farm level, or that it is not needed (unemployed, profitable technology exists). The third assumption has already been discussed. The first two assumptions no doubt result from the widespread availability and use of the so- called modern inputs in the developed countries. It is simply a matter of adapting those inputs to new conditions. The recent development of the high yielding rice and wheat varieties (HYV's) has also lulled development specialists into complacence. However, very often the new technology has not been locally adapted or tested under conditions similar to those faced by the farmer. Or, if shown to be physically better under local conditions, such technology still may be unprofitable.

On the positive side, studies in Africa show new innovations to be profitable for farmers in parts of Zambia and Rhodesia.[10] New and profitable technologies were also successfully introduced with credit in Mexico, Ethiopia, and Colombia.[11] Sacay generally concluded that the new rice varieties were profitable in the Philippines during the regular rice growing season.[12] On the other hand, for a different province in the Philippines, Smith states that "in the lower price ranges which prevail, the HYV technology is less profitable, per crop, than the lower yielding traditional methodology, for the typical yields cited."[13] Sacay also found lower yields during the dry season for the high yielding varieties, as compared with the yields of the traditional varieties. Large yield variations were also found in India.[14] Similar experiences can be drawn from many other countries.

Therefore, it should not be too surprising to find slower rates of adoption of new techniques when additional risk is involved or when the technique is less profitable than prevailing techniques. Fogg found a direct relationship between the adoption of a new technology and its monetary return to the farmer in Nigeria.[15] A similar relationship was found in Pakistan.[16] On the other hand, for wheat and corn production in Argentina, it was found that "the major limiting factor (was) the real unavailability of the fertilizer technology for farmers in the sense that technical and economic information on its use (was) almost totally nonexistent.[17]

What is often assumed profitable is, in fact, less so for the farmer. A rigorous test of profitability (requiring a 50 percent

margin for risk and uncertainty) from a carefully selected set of improved practices in a district in India showed that over half of the demonstrations did not pay.[18] Often, by the time the innovation gets to the farmer, it is even less profitable and attractive than that found under demonstration conditions due to soil, climatic, and other factors. Oluwasanmi and Alao concluded that the farm credit schemes in Nigeria have only a limited effect so long as they are operated without due regard to the earning capabilities of the innovations being financed.[19] Unfortunately, very little or no testing of the profitability of recommended practices by the lending agency takes place at the farm level.

Thus, to assume that all new technology is profitable, especially for the small farmer, is very questionable. Even with the new wheat and rice varieties, a small farmer is not always assured a profit above that found in using traditional varieties. The factors or components which determine profitability are many. These include relative prices of the inputs and products, land tenure arrangements, risk, knowledge and skill of the farmer, and the transportation and marketing systems. But the most important component is output-increasing or cost-reducing technology, the absence of which will limit the effectiveness of any credit program.

If our objective is small farmer development, then research must be oriented to produce those output-increasing or cost-saving technologies appropriate for small farms. Too often, research is designed to provide new knowledge for the medium and large-sized units. Also, experiment stations are located on the best land with good water availability, a far cry from the conditions under which many small farmers operate. The final test of a research recommendation is its economic performance for the farmer. Said another way, credit programs must shift the present emphasis of paper performance to field performance on the farmer's land.

In summary, there is sufficient evidence from credit studies to suggest that profitable technology is not always available to the farmer when the credit is extended. Furthermore, an important explanation for the low profitability is the lack of new, output-increasing or cost-reducing technology. New, appropriate technology may be the key to small farmer programs, as well as to the general development of the LDC's.

SMALL FARMER TECHNOLOGIES

Fortunately, the new HYV technology has been neutral to farm size, although small farmers have not adopted it as rapidly as larger farmers--for many reasons--one of which was lack of credit.[20] But should other kinds of technologies be developed to better assist the small farmer? This question can only be answered by thoroughly researching the problems faced by the small farmers and designing research to fit those needs.

However, a cursory review of small farmer studies does suggest a number of researchable areas appropriate for solving their production problems and constraints. Some possibilities include:

1. new water management techniques for storing and using water, including the economics of small scale irrigation projects;

2. water-nutrient interactions for crops presently grown on small farms as well as those with potential, i.e., horticultural crops, fruits and nuts, especially under less-than-ideal rainfall or under-irrigated conditions;

3. new output-increasing techniques for the more traditional crops such as cassava, potatoes, and legumes and for livestock activities;

4. information on the sensitivity of yields to land preparation and time of planting;

5. feeding rations utilizing the increased output from the traditional crops;

6. seeds with high yields but with less variation under different climatic conditions;

7. new animal-powered farm implements;

8. mechanical tillers and other small power implements, as needed;

9. low-cost and effective on-farm storage and drying facilities;

10. new techniques of multiple- and inter-cropping to increase incomes and reduce risk;

11. techniques for improving managerial skill.

The aforementioned research topics: 1) tend to enhance rural employment when solutions are found, 2) specifically relate to the needs of small farmers, and 3) are presently poorly researched. Fortunately, the international research institutes, as well as some LDC research stations, are now beginning to shift a portion of their research funds to meet the needs of small farmers. For example, over the past few years, the International Rice Research Institute has carried out research on the effects of successively planting different crops on the same plot (multiple-cropping), as well as planting more than one crop in the same field at the same time (inter-cropping). Interestingly, it was found that in the tropics total production increased when crops were inter-cropped.[21] Inter-cropping also significantly affected weed and insect populations. As is widely known, small farmers around the world practice inter-cropping and perhaps with reason. Thus, mono-crop recommendations may not be as appropriate for small farmer adoption as is often assumed.

New technology, even for small farmers, is not always neutral in its effects. Some groups may receive more benefits than others. The CADU program in Ethiopia is especially illustrative of the possible negative distributive effects of new technology, even when focused on small farmers.[22] CADU was successful in promoting the adoption of new wheat technology, but this resulted in increased land values which then caused widespread eviction of small renters by landlords. Thus, the existing land tenure structure created landless laborers which further aggravates the unemployment and income distribution problems. Uchendu also suggests that change agents in Africa must be especially aware of the tenure implications of new innovations which they promote.[23] A recent article on Latin America predicts that a continual improvement of agricultural technology without structural change will only accelerate the displacement of farm labor, transferring rural unemployment and poverty to the cities where there are too few available jobs now.[24] Cepede makes a similar plea for land reform.[25] Nair fears that

the Green Revolution could lead to a displacement of millions of farmers in India unless policies to bring about modernization of small farms are followed.[26]

It is clear that new technology is not neutral in terms of farm size, effect on employment, or income distribution. Therefore, those who develop and promote innovations, including the international lending agencies, must be especially sensitive to the distributive effects of such innovations.

Even if new technology is provided with credit, this may still not be sufficient for rapid adoption. If considerably more risk is associated with the new, as compared with the old, then small farmers may be unwilling to assume such risk. This is the subject of discussion to follow.

RISK AND ADOPTION

Researchers are recognizing more and more that risk is a significant factor in small farmer decision making. Wharton rightly recognized that even the most illiterate farmers place probabilities on the outcomes of their farming decisions.[27] They also subjectively place probabilities on future events outside their own experience. Since they cannot accept risks which might jeopardize their families' survival, their economic decisions attempt to avoid risk and to increase security. Naidu argued that increased farm investment will take place only when risks are removed from the minds of farmers.[28] Small farmers face a number of risks which can significantly affect the extent to which they adopt new technology.

Yield variability is probably the most serious risk faced by small farmers. The new technologies consistently show greater yield variation than do the traditional methods. As discussed in the previous section, under adverse weather conditions, the high yielding varieties sometimes yield even less than the traditional varieties; while under ideal conditions, the yields are often four to five times more. There is an obvious need to develop varieties which show less yield variability, even at the expense of some reduction in average yields. Malya and Rajagopalan found that Indian farmers in districts with uncertain rainfall conditions kept

a higher percentage of their crop area under drought resistant crops than others with less uncertain rainfall.[29]

New output variations also result from applying technologies which are inappropriate for the local soil or climatic conditions. For example, in Indonesia one technological package was recommended for a wide area. Experience showed that considerably more flexibility was required to match the varying local conditions. The more successful credit programs normally provided many "packages" to overcome local differences. Farmers must also consider the uncertainties of floods, insects, diseases, animals, and wars, all of which might adversely affect the yield obtained in any given year. Crop insurance programs hold some promise for spreading the weather risks faced by farmers among years and areas, but these must be applied with great care.

Price variability of the inputs or products is also of concern to the farmer. Input and product prices are exogenous factors which fluctuate from year to year, yet the farmer must predict specific values for each before the crop season. Kahlon and Johl found that Indian farmers varied acreages with price and yield variations and that a "risk fund" was used to meet their expected "conceptual risks," the fund growing in size with the use of new technology.[30] Governmental price guarantees may help, but these policies are also subject to change even during the crop year. Neverthless, price stabilization policies directly affect the profitability of new technology and are especially needed for those who have a high risk aversion--and that would include almost all the small farmers. The more successful credit programs have been supported by price policies which reduced the input and product price variability to the farmer.

The variability of the supply of inputs is another problem area for small farmers. A decrease in the total supply of fertilizer, chemicals, implements, and other inputs will be felt first by the small farmer. His limited economic resources and political influences make him vulnerable to shortages. Thus, he must weigh the risks of delayed inputs. Many small farmers have limited rights to water, an additional input risk, even if they are in an irrigation district.

The supply of services can also be highly variable. If the profitability of a new technological package depends on receiving

technical guidance through the production period, will such help in fact be available? The improper application of fertilizer or chemicals can significantly reduce crop yields. Livestock activities might be especially vulnerable to a delay in technical advice. Marketing services might also be uncertain and reduce profits. For example, can a dairy farmer always rely on the established milk pickup system?

In summary, it should be obvious that the adoption of new technology and its profitability is significantly affected by the associated risks. The dominant failure in much developmental work related to technological innovations has been the lack of understanding of the relationship between the expected variance of the old and new techniques and the relationship of these to the level of living of the clientele.

TECHNICAL ASSISTANCE

Extension is the mechanism by which the new technology is developed, modified, carried, and translated to the farmer in coordination with the provision of credit, when needed.[31] It is the technical assistance arm of the program. It was mentioned in the previous section that technical recommendations must be modified from area to area to meet local conditions. Who could better do this modification than the person who is explaining and demonstrating new innovations directly to the farmers? In addition, Dandekar wisely argues that "What is required . . . is some arrangement by means of which at least a small number of progressive and intelligent farmers . . . may participate actively in the research experimentation."[32] Such an arrangement would help ensure that the experimentation takes place under conditions similar to those faced by small farmers and the results, then, would more likely meet their needs. Each effort reinforces the other.

Including technical assistance as part of a credit program implies the need for considerable manpower and trained manpower as well. This cannot be denied. But the problem of training technicians is not the main issue. Development of the small farmer is the issue, and, if the development of new technology is a prerequisite for that effort, then policies must be established to ensure that effective technical assistance is made available.

Unfortunately, credit employees are often poorly trained in the technical areas of crop and livestock production, even in the so-called supervised agricultural credit programs.[33] In essence, the extension agent has very little to "extend" to the farmer. "The source of the new information must be considered trustworthy by the farmer, and this judgment will be based again largely on his past experience."[34] Obviously, an extension agent or credit technician with little technical advice to offer is not going to develop very much farmer trust. In addition, sufficient, trained manpower to provide trustworthy assistance is usually not available to small farmer credit programs, as reported in many country studies. If the LDC's are unable to finance this training, then the international lending agencies would be well-advised to set aside a portion of the agricultural credit loan itself for such technical training.

Combining technical assistance with extension of credit has a number of other advantages. Costs may be reduced by eliminating transportation and other costs which are duplicated if two separate agencies are visiting the same farmers. Less conflict exists where both activities are within the same agency. Farmers have only one contact or agency to work with, versus the many that exist now, and the provision of credit and technology will be better coordinated.

The extension agent-technician contributes in other ways, too: he coordinates the provision of the new inputs and credit, he can identify weakness in the technical recommendations, he can identify research needs, and he can help coordinate production and marketing activities. Thus, his very presence and participation helps eliminate or at least reduce the risks faced by the small farmer when adopting the new technology.

Another common feature of most of the more successful credit programs, besides jointly providing new technology, credit, and technical assistance, is the way the farmer is reached. In most instances, a local farmer serves as a liaison between the program technician and the rest of the farmers in the immediate area.[35] This farmer, who in some cases is elected by the other farmers or in other cases selected by the technician, receives special instruction and training on how to use the new technology. A part of his farm is usually held as a local demonstration plot. This organizational arrangement has two important consequences: 1) the

technician can effectively reach more farmers, an important consideration since few are being reached now, and 2) the farmer is able to translate the technical language into more easily understood local terminology.

Thus, the evidence, albeit tenuous, does suggest that t here is much to be gained by providing technical assistance along with credit. Just providing new technical inputs and credit is not as effective--adoption is slower--as providing inputs, credit, and assistance together. Also, some form of group organization, at least at the farm level, appears necessary to effectively reach a mu ch larger number of farmers without a significantly large increase in costs. The model farmer link tied to such a group also holds some promise.

In summary, this discussion has focused on only a few, but important parts, of the general issue of agricultural credit for small farmers. It has been argued that small farmer credit programs will usually fail to raise farm output and income, and can invite defaults, unless the credit is accompanied by new technology which is actually profitable to the farmer in conditions he faces. Adoption of new methods is often hampered by the small farmer's justifiable risk aversion and by inadequate provision of information and inputs. Thus, credit programs will need to find ways to reduce the risk associated with adoption or be willing to bear some of the risk through crop insurance programs or loan write-offs. Placing additional emphasis on the technical assistance responsibilities of the lending agency will also reduce the risk of providing poor information to the farmer and help assure inputs are available when needed.

FOOTNOTES

[1]E. B. Rice, History of A. I. D. Programs in Agricultural Credit, A. I. D. Spring Review of Small Farmer Credit, no. SR 118, vol. XVIII (Washinton, D. C.: Agency for International Development, June 1973), p. 25.

[2]The Group includes the International Bank for Reconstruction and Development, commonly referred to as The World Bank; the International Development Association (IDA); and the International Finance Corporation (IFC).

[3]International Bank for Reconstruction and Development, World Bank/IDA Annual Report (Washington, D. C.: International Bank for Reconstruction and Development, 1973), p. 15.

[4]A total of 20 volumes were published as a result of the A. I. D. Spring Review of Small Farmer Credit.

[5]Chester Baker, "Role of Credit in the Economic Development of Small Farm Agriculture," Small Farmer Credit Analytical Papers, A. I. D. Spring Review of Small Farmer Credit, no. SR 119, vol. XIX (Washington, D. C.: Agency for International Development, June, 1973), p. 45.

[6]This part is a condensed summary of sections from an earlier paper: R. L. Tinnermeier, "Technology, Profit, and Agricultural Credit," Small Farmer Credit Analytical Papers, A. I. D. Spring Review of Small Farmer Credit, no. SR 119, vol. XIX (Washington, D. C.: Agency for International Development, June 1973) pp. 93-111.

[7]Jerry Eckert, "The Economics of Fertilizing Dwarf Wheats in Pakistan's Punjab" (mimeographed paper, Lahore, Pakistan: The Ford Foundation, 1971).

[8]Richard L. Meyer, et al., "Rural Capital Markets and Small Farmers in Brazil, 1960-1972," Small Farmer Credit in South America, A. I. D. Spring Review of Small Farmer Credit, no. SR 103, vol. III (Washington, D. C.: Agency for International Development, February 1973), pp. 42-43.

[9]Klaus W. Bethke, "Small Farmer Credit Programs in Latin America: Some Experiences and Policy Problems," paper presented at the Agricultural Development Council Research and Training Network Workshop on Agricultural Credit for Small Farmers in LDC's, Arlington, Va., 6-7 April 1972.

[10]R. A. J. Roberts, "The Role of Money in the Development of Farming in the Mumbwa and Katete Areas of Zambia," Small Farmer Credit in Africa, A. I. D. Spring Review of Small Farmer Credit, no. SR 106, vol. VI (Washington, D. C.: Agency for International Development, February 1973), pp. 7-24.

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[13]Kenneth Smith, "Palay Productivity and Profitability in Iloilo, 1971-1972," Small Farmer Credit in the Philippines, A. I. D. Spring Review of Small Farmer Credit, no. SR 113, vol. XIII (Washington, D. C.: Agency for International Development, February 1973), p. 3.

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[15]C. D. Fogg, "Economic and Social Factors Affecting the Development of Smallholder Agriculture in Eastern Nigeria," American Journal of Agricultural Economics 13 (1965): 278-92.

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[17]Alain De Janvry, "Optimal Levels of Fertilization under Risk: The Potential for Corn and Wheat Fertilization under Alternative Price Policies in Argentina," American Journal of Agricultural Economics 54 (February 1972): 1-10.

[18]John W. Mellor, The Economics of Agricultural Development (Ithaca, N. Y.: Cornell University Press, 1966), pp. 278-79.

[19]H. A. Oluwasanmi and J. A. Alao, "The Role of Credit in the Transformation of Traditional Agriculture: The Western Nigerian Experience," Bulletin of Rural Economics and Sociology 1 (1964): 58-74.

[20]Lack of credit usually becomes a constraint for small farmers once they begin widespread adoption of new technology. Michael Schulter [Differential Rates of Adoption of the New Seed Varieties in India: The Problem of the Small Farm, Occasional Paper Number 47 (Ithaca, N. Y.: Department of Agricultural Economics, Cornell University, USAID--Employment and Income Distribution Project, 1971)] found a greater percentage of cash expenditures was borrowed by small farmers who adopt new technology when compared with larger farmers, demonstrating more small farmer dependence on credit. In Pakistan, Carl Gotsch ["Technical Change and the Distribution of Income in Rural Areas," American Journal of Agricultural Economics 54 (May 1972): 326-341] found less dependence on credit for the adoption of new inputs, other than tubewells, while a second researcher found the opposite [Max Lowdermilk, "Diffusion of Dwarf Wheat Production Technology in Pakistan's Punjab," Small Farmer Credit-HYV in Pakistan, A. I. D. Spring Review of Small Farmer Credit, no. SR 114, vol. XIV (Washington, D. C.: Agency for International Development, June 1973),

pp. 218-223, 267-298]. The Spring Review papers generally conclude that credit does become a problem for small farmers once adoption takes place.

[21]International Rice Research Institute, "Multiple Cropping 1972 Annual Report" (mimeographed, Los Banos, Philippines: International Rice Research Institute, 1972).

[22]Homberg, "The Credit Programme . . . in Ethiopia," pp. 54-59, 74-76.

[23]Victor C. Uchendu, "The Impact of Changing Agricultural Technology on African Land Tenure," The Journal of Developing Areas (July 1970): 477-86.

[24]Solon Barrachough and Jacobo Schatan, "Technological Policy and Agricultural Development," Land Economics XLIX (May 1973): 175-194.

[25]Michel Cepede, "The Green Revolution and Employment," International Labour Review 105 (January 1972): 1-8.

[26]Kusum Nair, "Modernization or Obsolescence of the Indian Farmer," Development Digest VII (October 1969), pp. 42-48.

[27]Clifton R. Wharton, Jr., "Risk, Uncertainty and the Subsistence Farmer: Technological Innovation and Resistance to Change in the Context of Survival," paper presented at the Joint Session American Economic Association and Association for Comparative Economics, Chicago, Ill., (December 1968).

[28]V. T. Naidu, "Risk and Uncertainty in Agriculture in Relation to Credit," Indian Journal of Agricultural Economics 19 (January-March 1964): 129-132.

[29]M. M. Malya and R. Rajagopalan, "Nature of Risk Associated with Rainfall and its Effect on Farming--A Case Study of Kurnool District, Andhra Pradesh," Indian Journal of Agricultural Economics 19 (January-March 1964): 76-81.

[30]A. S. Kahlon and S. S. Johl, "Nature and Role of Risk and Uncertainty in Agriculture," Indian Journal of Agricultural Economics 19 (January-March 1964): 82-88.

[31]Extension in the context of this discussion is any educational program directly tied to disseminating new technology. Thus, an "effective" extension program would be one which significantly increased the adoption of the new technology as compared with the level of adoption which would take place in its absence.

[32]Quoted in: Francis C. Byrnes, Some Missing Variables in Diffusion Research and Innovation Strategy, Reprint Series (New York: Agricultural Development Council, March 1968).

[33]Ronald L. Tinnermeier, et al., "An Evaluation of Selected Supervised Agricultural Credit Programs in Peru" (report to the Government of Peru and USA ID, North Carolina State University Agricultural Mission, Lima, Peru, June 1968).

[34]Delbert T. Myren, "The Role of Information in Farm Decisions under Conditions of High Risk and Uncertainty," presented at the Symposium on the Role of Communications in Agricultural Development, Mexico City, October 1964.

[35]The role of farmer cooperatives or groups in this process is unclear. The Comilla project stressed the development of cooperatives while most of the other relatively successful credit programs placed little or no emphasis on organizing groups.

Chapter VII
Livestock Production on Small Farms as a Contribution to Economic Development

Gerald M. Ward*

Intensive animal production has never been important in the agriculture of the world's less developed countries, basically because animals compete with man for land on which to produce crops. Today there is at least the hope that the basic caloric requirements of many of the world's underfed can be satisfied by the cereals resulting from the Green Revolution. If this is so, an accelerating interest in animal production may be forthcoming that can contribute to improved human nutrition and at the same time provide the basis for sorely needed increases in rural employment. In addition to these advantages of animal production, the hypothesis presented here is that small-scale intensive animal production has special merit for training peasants to participate in general economic development.[1] This hypothesis is derived from a study of the historical development of agriculture. The one historical model for study of the relation between development of intensive livestock production and economic development is the experience of Western civilization, meaning the economically advanced countries of northern Europe and their former colonies in the temperate zones of the New World and Australia.

Toynbee distinguishes 21 civilizations since the dawn of recorded history. Western civilization, currently the dominant civilization, began its rise to eminence sometime about 1750. Explaining the "Rise of the West" has long been a popular intellectual exercise. The explanations offered are as diverse as the interests of the explainers: racial superiority, climate, the potato, piracy and the Protestant ethic, as well as the more quantitative explanations of the economists. Agriculture has not received much consideration in explaining the material success of Western civilization, despite the fact that all civilizations started from a position where almost the only source of wealth was agriculture, and nearly all the population was working in agriculture. Agriculturally,

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there is one enormous difference between the 21 earlier civilizations and Western civilization. All of the previous 21 were entirely or primarily dependent upon irrigation agriculture. Wittfogel has analyzed what he calls "hydraulic societies" in terms of their political but not their agricultural structure.[2] He concludes that hydraulic societies naturally developed into despotism because a central authority was necessary to control and distribute the one pre-eminent resource, water. Individual decision making was necessarily subjugated in order to maximize cereal production.

The agriculture which became the basis of the Western Christian civilization was, by comparison, developed in the humid, once forested regions of northwestern Europe where irrigation was unnecessary. Animal agriculture was simple because the natural rainfall provided for the growth of grass for feed on any unused land. Grass production may not have been good by present day standards, but it would keep animals alive the year around. On the other hand, the older societies located in arid and semi-arid regions and dependent upon irrigation found that the land outside their irrigated areas was either barren or subject to long seasonal droughts. Thus, the surrounding non-irrigated lands were in the hands of nomads who were generally of another culture. The members of the hydraulic societies were descendents of Abel while the descendants of Cain claimed the arid grazing lands. The traditional separation between herders and farmers is probably an important factor in limiting the introduction of mixed crop and livestock type of farming which long ago became the custom of peasants in the West.

ECONOMIC CYCLES AND AGRICULTURAL CHANGES

The agricultural history of Europe and especially northern Europe has been studied by several historians.[3] The comprehensive economic studies of Slicher van Bath include much information on development and animal production and their relation to price cycles and economic activity during the Middle Ages and up to 1850[4].

Three great cycles of population, agriculture, and commercial activity can be distinguished in European history. In the Middle Ages population, prices, and demand for grain reached a crest in the late thirteenth century followed by famine, depopulation and

depressed prices. The nadir was about 1350 when the Black Death reduced the population of Europe by perhaps one-third. Following the Black Death, recovery of population and business activity occurred slowly, reaching a peak in the late sixteenth or early seventeenth century, i.e., the Elizabethan period. Another long period (1650-1750) of economic depression followed and was accompanied by, or caused by, a stagnation in population growth. About 1750 an accelerated rate of population growth began another cycle which continues until today and was responsible for the Industrial Revolution.

During periods of increasing population, grain prices were high; however, periods of depopulation or slow population growth were characterized by a decreased demand and falling prices for grain. The reason for this is that wages were higher during periods of low population with the result that the demand increased for animal products such as wool, meat, butter, eggs and cheese relative to that for grain reflecting a higher income elasticity for demand for animal products. [5]

A change to intensive livestock production appears to have been the general response in the more densely settled regions of Europe during the period of the agricultural depression, 1650-1750, which preceded the Industrial Revolution. [6] The most advanced agriculture at this time was associated with the areas of the greatest population density. "In the Netherlands the high degree of agricultural development must be attributed to great number of inhabitants - the reason for the transition to intensive cultivation was not wealth but necessity." [7]

REVOLUTION IN ANIMAL PRODUCTION PRECEDING THE INDUSTRIAL REVOLUTION (1650-1750)

Slow population growth and competition from grain produced in eastern Europe by serf labor reduced the returns from arable farming in western Europe, while at the same time the market for livestock and livestock products was relatively more favorable. However, because additional land generally was not available for pasture and forage production, the general response was a more labor intensive farming to provide feed for livestock. Crops produced for industrial uses such as hops, dye plants, etc., also increased during this period. More intensive crop production was

achieved by artificial manures, water control (both by drainage and irrigation methods) and especially by the introduction of clover and turnips. These new methods made it possible for the first time to store sufficient feed so that farm animals could continue growth and milk production during winter months. Commonly the best that had been expected in earlier times was that livestock would survive until the grass turned green again in the spring. The production, harvesting, storing, and winter feeding with these crops meant greatly increased labor requirements for animal production as compared to earlier days when children and old women herded the animals wherever they might find forage.

The changes in farming outlined above for northern Europe during the period of 1650-1750 were apparently almost duplicated in the Po Valley of Italy in the fourteenth century according to Cipolla[8] and Zangheri.[9] Intensive animal production in the form of dairy farming developed and grains were imported. Northern Italy in the fourteenth century was the richest and probably the most densely populated part of Europe. In this respect there is an interesting similarity between the Italy of the fourteenth century and the relatively affluent and densely populated regions of the Low Countries and Britain in the seventeenth century. In both cases declines in grain prices seem to have been the stimulus for a shift from arable to relatively more intensive livestock farming.

An agricultural revolution preceded England's Industrial Revolution and other industrialized countries of Europe likewise appear to have had a dramatic change in agricultural systems preceding their period of industrialization.[10] Zangheri has discussed the factors that prevented the transition from advanced agriculture to industrialization in Italy.[11] This example may be relevant to the situation of today's developing countries.

If it is true, as appears, that intensive livestock production and industrialization are generally found in close association, what is the explanation? The likely answer would be that only in industrialized regions will per capita incomes be sufficient to provide a market for the more expensive products of animal agriculture. High correlations are found today between per capita national income and consumption of animal products which tend to support this explanation.[12]

The historical importance of livestock farming is illustrated by this quote written in 1789 on the eve of the French Revolution:

> "The consumption of cheese in England, by the poor, is immense. In France they eat none at all. The English consumption of meat is infinitely more beneficial to agriculture than the French consumption of bread. It is by means of great stocks of cattle and sheep, that lands are of an ameliorating nature; but those that yield bread are, on the contrary, exhausting. It must be therefore evident that agriculture will be advanced in proportion to the quantity of meat, butter, and cheese consumed by any nation."[13]

A close geographic relation can be detected today between intensive livestock production, and industrial development; in the north as compared to the south in France, Spain, Italy, Yugoslavia, and in the United States, and between west and east in Germany and nearly all Eastern European countries. A similar comparison can be made between the livestock areas of the Alpine and mountain regions of Europe and the grain producing areas of the plains. Industrialization typically developed first in the Alpine and foothill regions of Switzerland, Austria, Italy, Poland and Spain.

THE RELATION BETWEEN LIVESTOCK PRODUCTION AND INDUSTRIALIZATION

The hypothesis presented here is that because intensive animal production demanded increased skills and regular hard work, it prepared a disciplined labor force for industrialization. It also prepared entrepreneurs who had experience in decision making and marketing in a money economy as livestock producers.

There should be no question that harder work the year around was necessary for livestock farming. This is perhaps best exemplified by the extreme demands of Alpine dairy production as described by Dumont.[14] Boserup has pointed out that a peasantry disciplined to hard work is better suited for industrial work.[15] Peasants from livestock farming areas provided the labor force for earlier industrialization.[16]

Intensive animal production requires special skills with daily attention throughout the year. Landlords have found it difficult to obtain these specialized skills and attention from serfs or laborers. On the other hand, the peasant who has the prospect for reaping the entire profit is often prepared to invest an enormous amount of time and energy in the enterprise. Personal skill, individual initiative, and tedious work has a much greater effect upon livestock productivity than upon cereal production. A good husbandman is more likely to obtain proportionately more financial returns from his labor and skill devoted to livestock than from efforts in extensive agriculture. Similar advantages may be associated with production of specialized crops, but the necessary capital investments were greater for cattle and the returns much greater.

Resorting to intensive livestock production has been a response to declining farm prices in the United States as late as the 1930's. A response to declining farm prices similar to that seen in seventeenth and eighteenth century Europe could be seen where farmers turned to the more laborious work of intensive animal production. The pig was known as the "mortgage lifter" and was the resort of hard pressed farmers. Farmers turned to milking cows during hard times. As economic conditions improved, farmers turned to raising beef cattle and then generally eliminated all livestock in order to produce only crops for the market when these would produce an acceptable income. The following, which refers to mid-nineteenth century New England also illustrates this point. "The shift from beef cattle and sheep to dairying was accomplished only under heavy economic pressures. Few farmers unaccustomed to dairying could relish the thought of being 'tied to a cow's tail' for 365 days a year."[17] It was suggested here that intensive livestock production may be a steppingstone to greater prosperity for the small farmer and his children. However, it should be repeated that this possibility may be at the cost of being "tied to a cow's tail." Labor requirements may equal that expended in the past by Alpine dairymen or the Dutch peasants.

The opportunity for pre-industrial peasants to profit from capital investments and innovation in livestock enterprises was probably greater than for peasants today in developing countries. The former were seemingly better able to control the spending of tax money which commonly included emphasis upon schools - a necessity for development that was seldom or never furnished by large landowners. It is certain that larger proportions of the total

population in those areas where small-scale individual farms were found became literate and well educated, compared to other regions.[18] Educational opportunities in various regions in the U. S. were likewise associated with the types of agriculture practiced.

Some of the characteristics of small-scale livestock producers which may have made them or their sons entrepreneurs were: frequent marketing in a money economy, greater control of their profits, savings and taxes, and individual independent decision making about their farming operations. Slicher van Bath indicates that it is a well-known phenomenon that in stock farming areas, money plays a greater part in the economy than in regions of arable farming perhaps because less of the total output is consumed on the farm.[19] The small-scale livestock producers from necessity and circumstances developed those characteristics which are now often described by Weber's term, "The Protestant Ethic." That these peasants tended to invest their money off the farm is indicated by the statement of de Tocqueville: "That one never sees more than one generation of rich peasants," -- meaning that the children of rich peasants take their money to the city.[20]

Animal production may have made another contribution to the development of the West by improving the nutritional status of the population. The diet of the people of Flanders during the Middle Ages was probably the best in the world,[21] despite the fact that the peasants depicted by Brueghel appear to have suffered from a variety of nutritionally related disorders. Very recent evidence indicates a link between adequate nutrition and mental development.[22] It seems likely that the people of northern Europe were better able to perform continuous hard work than their poorly fed contemporaries; that they were also intellectually superior because of their diet is a possibility, but is less certain.

Conclusions from a historical study of the relationship of agriculture and economic development in Europe can be summarized in the following fashion. The peasantry in the more densely settled regions of northern Europe were faced in the seventeenth century with a decline in grain prices. As a result, they turned to intensive livestock production mixed with more intensive crop production. Labor requirements per family were increased, the change was made to greater reliance on a money economy and

peasants acquired greater control of the profits which their products brought on the market. They became better educated. Some had money to invest in other enterprises which probably contributed to initiation of the Industrial Revolution. The general population had developed the discipline of hard and regular work which was essential for industrialization. Their superior diets resulting from animal products probably made more than an incidental contribution to their health, work capacity and possibly to their mental ability. Economic forces turned them to animal production which ultimately made them more affluent and skilled than their contemporaries, providing the human capital for the launching of the Industrial Revolution.

By comparison, the peasantry of the grain producing areas of eastern and southern Europe were forced into serfdom or some form of servile tenancy as a response to declining grain prices. The peasantry of the ancient irrigated regions were unable to change their type of agriculture because any agriculture except nomadic husbandry depended upon an elaborate water control system which was controlled by a central authority largely for the benefit of an elite class.

The tenacity of agricultural systems is indicated by the degree to which various societies have been able to transplant and maintain their own agricultural and social structure in new regions. The English transplanted their system of small-scale family farming prevalent in the seventeenth century to the humid temperate zone of North America, and Australia, while in parts of South America with agricultural conditions similar to the United States, Canada, and Australia, a semi-feudal agricultural system has persisted derived from Iberian colonial heritage. The agricultural and social system of France in the seventeenth century can still be detected in the land tenure of eastern Quebec. The expansion of the Russian and Chinese Empires likewise carried their agricultural and social systems into vast areas.

IMPLICATION FOR DEVELOPMENT PROGRAMS

The long range national plans of many developing countries include considerable emphasis upon increased animal production. What are the prospects for people who have been tied for centuries to ancient agricultural systems, to develop an animal industry

which can help alleviate the widespread symptoms of protein malnutrition? We have suggested above that a change from agriculture based upon cereal production was an important factor not only in improving average nutritional status but in launching Europe's Industrial Revolution. Nearly all developing countries are interested in industrialization and would welcome an assist from agriculture. Bairoch has discussed the problem which less developed countries face in trying to duplicate the agricultural and industrial revolutions that occurred in Europe a century ago.[23]

Despite the desirability of increasing livestock production, there are serious limitations in the developing countries, most of which are located in tropical or subtropical regions. By comparison, the developed countries are in humid temperate regions where grass and forage of good quality grows more naturally than in the hot or arid regions. Climatic effects place a direct restraint upon animal production but of greater importance is the effect of climate and land scarcity upon fodder production. Domestic animals in these countries are essentially scavengers, because nearly all the arable land is utilized to provide food intended for direct comsumption by man. Animal production means a less efficient use of plant products for food production. The comparative efficiency of livestock and plants, however, is not a meaningful question so long as animals act as scavengers because by definition they subsist upon what man can not or will not eat. If livestock production is to be increased significantly, then farm animals will compete with man either for food such as cereals or for the land needed to produce fodder. Commonly as a population density has increased cheaper foods are introduced such as the replacement of cereals by cassava or manioc[24] and in Europe the substitution of potatoes for bread.[25] The Industrial Revolution was apparently accompanied in its early years by a severe decline in the quality of the average diet. This historical pattern does not add confidence for the future possibilities of animal products improving diets in developing countries with high population growth rates.

A limitation on animal production of equal importance to questions of efficiency is the fact that consumption of animal products is closely tied to income. A recent summary includes a treatment of the relation between income and meat consumption and indicates a strong increase in demand with increasing cash incomes even at rather low incomes.[26] The desire for animal protein is great and would probably remain high even if the need for

protein could be satisfied by high quality plant proteins or by synthetic amino acids. It is a common conclusion that industrialization is a necessary prelude to diets containing milk, meat, cheese, and eggs. However, the European historical example suggests that perhaps if livestock production can be improved it will generate the impetus for improving national income as well as improving human nutrition.

The agriculture of the underdeveloped countries can be divided roughly into three categories: 1) the ancient hydraulic societies which include the greatest mass of the world's people; 2) populations depending upon shifting agriculture of various degrees of extensive land use, and; 3) the nomadic and semi-nomadic populations found on arid or desert lands. Considering the prospects for each of the three agricultural systems for livestock production, the nomads and semi-nomads are already livestock raisers; however, the productivity of their animals is extremely low due to great seasonal variations in the amount and quality of feed reflecting in turn inadequate and uncertain rainfall. The only long term solution for their material welfare appears to be resettlement as sedentary farmers at least partially dependent upon irrigation.

The situation of the shifting cultivators is more optimistic. The productivity of their land probably can be increased by increasing the labor intensity. The thesis of Boserup suggests that expanding population will force these into more intensive cultivation.[27] Livestock might be included in their agricultural system if some revolutionary methods can be introduced for the feeding and husbandry of animals in the tropics. The development of high-yielding cereal varieties combined with the application of fertilizer and water has resulted in the Green Revolution. We also have "miracle" animal species whose potential can be realized if proper feed, disease control, and management inputs can be provided. The result may well be a comparable increase in meat and milk production -- a Red and White Revolution.

Large increases in animal production by the ancient hydraulic societies may be possible. It is in those areas that the Green Revolution is underway. If the promise of the miracle varieties materializes, land could be released for animal production. The incentives for commercial grain production may also be the stimulus for a greater degree of multiple cropping (two, or even three

crops per year). Intensive livestock production could be readily integrated into a multiple cropping system. All such prospects require a vast change in the society's current values. Some of the surplus grain and surplus land must be utilized to support animals and not to feed an ever increasing human population at a minimal level of nutrition.

The principle objection to a high priority for animal production in development plans is the high cost of animal products. What are the costs of production? Land is a major cost. It is highly probable that additional arable land will become available through more intensive crop production (fertilizer, irrigation) or multiple cropping of existing land. Until minimal caloric requirements can be satisfied by grains, we cannot conceive of intensive animal production. Labor could provide important capital needed for animal enterprises, such as construction of buildings, corrals, and more intensive crop production. Labor is the most abundant resource and although it already may be employed at peak periods, labor intensive animal production could provide better labor returns throughout the year if land tenure and market conditions permit. Harder work may be the salvation of people living by subsistence farming. History indicates this; European peasants were forced to harder work. Boserup has expanded this idea into the general theory that population growth is the stimulus for more productive agricultural methods; the hungry population resorts to a more labor intensive agriculture. The Boserup theory is rank heresy to Malthusians, because her explanation of the relation between food and population is the reverse of the generally accepted dogma. Livestock improvement programs now being proposed and initiated in developing countries mostly involve schemes of large scale which will probably worsen rather than improve the general unemployment situation.

In conclusion, national planning designed to stimulate livestock productions by small farmers seems to have many advantages for stimulating rural development and general economic growth. The well recognized advantages are: 1) improved nutrition of the population, 2) opportunities for increased rural employment, and 3) the possibility that the demands of intensive livestock production can provide valuable training for labor and entrepreneurs necessary for the economic development of a nation.

FOOTNOTES

[1]Intensive livestock production here refers to production of pigs, poultry, dairy cattle, fattened cattle, and sheep, with emphasis on cattle and sheep. The term excludes ranching, extensive stock breeding and nomadic or transhumance enterprises.

[2]Karl A. Wittfogel, Oriental Despotism, A Comparative Study of Total Power, (New Haven: Yale University Press, 1957).

[3]E. L. Jones and S. J. Woolf, eds., Agrarian Change and Economic Development. (London: Methuen and Co. Ltd., 1969), and R. H. Tawney, The Agrarian Problem in the Sixteenth Century. (New York: Harper & Row, 1967).

[4]B. H. Slicher van Bath, The Agrarian History of Western Europe, 500-1850. (New York: St. Martins Press, 1963).

[5]The following sources were used in describing these economic interrelationships: Ibid., pp. 142, 169, 210, 217, and 324; John Burnett, A History of the Cost of Living, (Baltimore: Penguin Books, 1969), p. 134; and G. B. Masefield, Cambridge History of Europe (Cambridge: Cambridge University Press, 1967), p. 415.

[6]Tawney, The Agrarian Problem, p. 403.

[7]Slicher van Bath, Agrarian History, p. 242.

[8]Carlo Cipolla, Une Crise Ignoree: Comment S'est Perdue la Propriete Ecclesiastique dans l'Italie due Nord entre le XI le XVI Siecle. Annales; Economies, Societes, Civilization. N.S. 1, 1946.

[9]R. Zangheri, "The Historical Relationship between Agriculture and Economic Development in Italy," in Agrarian Change and Economic Development, eds.: E. L. Jones and S. J. Woolf (London: Methuen and Co. Ltd., 1969), p. 35.

[10]Paul Bairoch, The Agricultural Revolution Came First," Ceres 2 (1969): 52.

[11]R. Zangheri, "The Historical Relationship," p. 46.

[12]J. F. Perisse and P. Francois Sizaret, "The Effect of Income on the Structure of Nutrition," Newsletter 7 (July-Sept., 1971): p. 1 and T. C. Byerly, The Role of Livestock in Food Production," J. Animal Sci., 25:552, 1966.

[13]Arthur Young, Travels in France During the Years 1787, 1788, 1789. (Garden City, New York: Doubleday and Company, Inc., 1969), p. 334.

[14]Rene Dumont, Types of Rural Economy. (London: Methuen and Co. Ltd., 1957).

[15]Ester Boserup, The Condition of Agricultural Growth. (London: George Allen and Unwin Ltd., 1968), p. 75.

[16]Slicher van Bath, Agrarian History, p. 241.

[17]R. G. Wheeler and John D. Black, Planning for Successful Dairying in New England, (Cambridge: Harvard University Press, 1955), p. 226.

[18]Carlo M. Cipolla, Literacy and Development in the West, (Baltimore: Penguin Books, Inc., 1969).

[19]Slicher van Bath, Agrarian History, p. 33.

[20]Alexis De Tocqueville, The Ancient Regime and the Revolution. (Baltimore: Penguin Books, Inc., 1965), p. 56.

[21]Slicher van Bath, Agrarian History, p. 89.

[22]N. S. Scrimshaw, "Infant Malnutrition and Adult Learning," Saturday Review of Literature 11 (March 16, 1968): 64.

[23]Bairoch, The Agricultural Revolution, cited in footnote 10.

[24]Boserup, The Conditions of Agricultural Growth, p. 109; and Dumont, Types of Rural Economy, p. 325.

[25]R. N. Salaman, The History and Social Influence of the Potato, (Cambridge: Cambridge Univ. Press, 1949), pp. 542 & 600.

[26]U. S., Department of Agriculture, Foreign Agriculture Economics Division, Growth in World Demand for Feed Grains Related to Meat and Livestock Products and Human Consumption of Grain, FAS Report No. 63 (Washington, D. C.: Government Printing Office, July, 1970).

[27]Boserup, Conditions of Agricultural Growth, p. 116-121.

Chapter VIII
Water User Organizations for Small Farmers

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Water management implies collective activity by individuals in the acquisition, delivery, use, and removal of the resource. In this paper we are concerned with local water management and how small farmers can increase their capability to utilize available resources through an appropriate organizational framework. Management effectiveness depends upon the existing physical conditions, the adoption of improved technology, economic capabilities, and the societal ability--either through individuals or irrigation institutions--to facilitate effective water management and prevent the development of institutional constraints. It is essential to examine all dimensions of local water management in terms of a system that can include the hydrological units, political units or jurisdiction, and the sub-systems for water management which may confine themselves to particular uses or areas. The institutional framework that evolves at the local level is not an end in itself in which the main objective is perpetuation of the institution; rather, it is a tool to achieve the goals and objectives of that particular group of individuals who have agreed to pursue a common objective. The goal of the institution is, therefore, ancillary to the individuals that create it.

IRRIGATION SYSTEMS AND THE SMALL FARMER

The existence of irrigation systems can be traced back to China as early as 2627 B. C. Lands were irrigated through systems of canals; in the 7th Century, a large 700 mile canal was constructed for irrigation and used secondarily for navigation. Other well-known irrigation systems were developed by the Aryans in the fertile but arid valleys of the Tigris-Euphrates and by the Egyptians in the Nile Valley. These irrigation systems, as well as others that developed throughout the world, were the result of an available water supply and natural conditions which allowed the distribution

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of waters to the lowlands. As the better lands were utilized along the river bottoms, simple to sophisticated delivery systems were developed. In addition, in most of these early civilizations, land along the major watercourses was settled by small farmers.

These agricultural societies have been classified into two categories by Wittfogel.[1] First, the hydro-agricultural society developed where small-scale farming took place in the arid and semi-arid areas in which crop production depended upon rainfall and intermittent flowing streams. Second, the agro-hydraulic systems evolved in areas where an abundant water supply was available but required the control of government to properly develop the resource. In both these systems the small farmer played a key role in the success attributable to those civilizations. Kinney observes that it was no accident that a high state of civilization developed with the practice of irrigation.[2] The water resources were intentionally utilized in a manner which required the best thought and effort of the farmers and system developers to economically convey the water and apply it to the land to produce the best crop yields.

A typical irrigation system can be subdivided into three sub-systems based on a physical categorization: 1) water delivery, 2) water use, and 3) water removal. The water delivery sub-system begins with diversion works and their associated control and flow systems along the river and ends where water is diverted into a canal and conveyed to farm outlets. The water use sub-system begins at the farmer's headgate, continues through his network of ditches distributing water to the fields, and ends at the point where any excess waters leave the irrigated area. The water removal component includes the surface and sub-surface drainage networks that exist naturally or are manmade.[3]

Agricultural uses of water proceed through a cycle that integrates the physical aspects with the institutional components associated with the right to use water just as water progresses through a hydrological cycle. Six use-functions give recognition to the hydraulic characteristics of water and the geographical location of irrigation systems. These functions are: 1) water supply--derived from natural, developed and induced sources, and from schemes for the reuse and recycling of water, 2) water control--by natural and artificial impoundments and diversions, 3) water conveyance--through a delivery network of canals and laterals, 4) water application--by the user, 5) water removal--through

tailwater ditches and drainage systems, and 6) return flow--to surface and groundwater sources with the emphasis upon quality instead of quantity of water.[4] In agricultural areas where the demand for water is expressed by many users, tradition, norms, policies and laws evolve that specify the rights and duties of the water developers and users for each water use function in the system. Figure 1 illustrates the interrelationships of the irrigation sub-systems, the water use functions, and institutional involvement.

Figure 1

IRRIGATED AGRICULTURAL AND INSTITUTIONAL INVOLVEMENT

Integrated Irrigation Sub-System	Agricultural Water Use Functions	Institutional Involvement
Delivery	Supply: -Natural (Ground & Surface) -Developed & Induced -Recycled & Reused	Defined to determine water rights in source
	Control	Authority and standards for diversion and impoundment
	Conveyance	Eminent domain and rights of ways
Use	Application	Exercise of right: -Beneficial use -Duty of water
Removal	Removal and Drainage	Waste
	Return-flow	Impairment of downstream rights

The small farmer in his traditional role has not been directly concerned with each of the functions of water use and legal controls. Population pressures, the smallness of individual holdings, lack of knowledge of new farming methods, and subsistence living in many countries are factors which have obstructed agricultural development and narrowed the individual farmer's horizon to primarily the water application function. Many small farmer problems can be solved by organizing them into groups who will contribute land (for the distribution system), labor, and money to take advantage of economies of scale. In other words, cooperative or collective farming can, if properly designed and implemented, provide an effective solution to their problems. To be most effective, flexibility should be allowed to give the agriculturalists in local areas the opportunity to adopt the types of organizational arrangements most acceptable to them. The use of good seed, fertilizer, combining small holdings into larger blocks, the proper alignment of irrigation channels, and crop rotation can be important in increasing productivity. Water user organizations can be extremely helpful in achieving all these improvements.

ORGANIZATIONAL SPECTRUM IN IRRIGATED AGRICULTURE

A wide array of organizational arrangements have evolved to develop and improve collectively the efficiency in utilization of local water resources.[5] The design and function of these entities depend upon the purpose and scope of authority. Their creation is the result of a natural phenomenon of social interaction. Initially, in most irrigation systems, water was diverted by individual farmers to lands near the streambeds. As these lands were settled and it was necessary to utilize lands at greater distances, the cost incurred in developing water transportation systems exceeded the financial and physical capabilities of the individual farmer so he was compelled to develop a cooperative arrangement with his neighbors.

The magnitude of this cooperation ranges all the way from independent actions by farmers in small groups to the most complex of local organizations. Induced cooperation among farmers is perhaps the earliest evidence of informal and non-structured organizations. For example, in the Middle Assyrian Laws of the 12th Century B. C., owners of fields were encouraged to cooperate with each other in irrigating their lands. Article 17 of the Laws states "If there is no cooperation among them (irrigators), the cooperative

one among them shall apply to the judges and procure the judges' written order and then he may do the work, take that water for himself and irrigate his field, with no one else irrigating from it."[6]

As was previously noted, the primary purpose for the creation of local irrigation organizations was to develop a water delivery system and, in later stages of development within the irrigation system, to add a water removal system. Farmers around the world are independent by nature and, therefore, are very inclined to minimize any interference with the rights that they have on their own properties. For this reason, the duties of irrigation companies or associations normally ends at the landowner's headgate and begins again with the waters that run off or seep from the lands. Some organizational alternatives that have developed in the United States and Spain will be examined and related to the developing countries in the following sections.

United States Alternatives

In the United States, particularly in the western part of the country, organizational arrangements at local levels were developed that were consistent with water legislation. The spectrum of organizational arrangements sanctioned by the water laws or authorized through special legislation can be classified into three categories: 1) private organizations--commercial irrigation companies and mutual irrigation companies, 2) quasi-private organizations--water user associations, and 3) quasi-public and public organizations--irrigation districts.

In the United States the predominate form of organizational arrangement is the private irrigation company. The so-called "commercial irrigation companies" were a phenomenon of the Western United States in the 1870's and 1880's and still exist in limited numbers. These profit-motivated companies were formed with private capital for the purpose of constructing or developing facilities, forming private contracting companies for the sale of water, or providing public utilities. Orginally the capital was raised by selling bonds to Eastern investors and frequently to persons in other countries.[7] The company would normally own the conveyance system through which water delivery services could be obtained.

These companies were speculative ventures; it was hoped the promised availability of water would bring people to the sparsely

settled West who would use the water in enough volume to produce sufficient income to cover the investors' costs plus profit. At the same time, the federal government was becoming seriously engaged in a program of settling the West. Some large farms appeared, but the majority of newcomers settled on small farms, by U. S. standards, of 100 to 200 acres. However, because farms take time to become profitable, the commercial companies generally did not prosper so new forms of organization emerged. These other forms did not depend on immediate profits since they were subsidized by the federal government or were non-profit associations of farmers, called mutual irrigation companies, who worked for their own benefit.

A "mutual irrigation company" may be defined as a private and voluntary association of farmers which is organized for the express purpose of furnishing water to the shareholders or members at cost. These companies developed independently in many western jurisdictions. They came into being naturally as diversions of water by individual farmers became increasingly difficult both physically and financially. Community cooperation seemed the only way to provide water so that everyone might prosper. These companies normally controlled only their main canals with the lateral ditches frequently being organized as separate entities.

Most mutual companies incorporated formally, although a few continue to this day as informal arrangements. Generally speaking, a mutual company is distinguished from the normal corporation by two major features:[8]

1. Assets are limited primarily to water rights and canal systems and sometimes to canal systems alone.

2. The corporation is not organized for profit but rather to distribute water to shareholders and otherwise operate and maintain the system.

Since delivery of a dependable water supply when needed was the primary objective of the mutual company, its benefactors had to be assured the company could make diversions of water in compliance with the western state water laws. Several schemes developed which reflect the direct relationships between the right to divert water (the company) and receive water (the farmer), and the obligation to make payment of assessed costs. In general, these schemes followed two patterns.

In the first case, water rights were acquired by the individual shareholders and either leased to the company or the company simply delivered to each water right holder his allocation of water. The shareholders/water-right holders were assessed operation and maintenance costs, prorated according to the volume of water delivered. This system works particularly well for small areas involving few farmers. Normally a company with this type of arrangement does not deliver water to other than the members of the company. A greater degree of flexibility is achieved if the water rights are leased to the company, thus allowing management decisions to be made in addition to administrative decisions.

The second pattern can best be described as management oriented. Instead of water rights being exercised in the name of the water users, the company either owns the water rights or requires the shareholders to assign their water rights to the company. Often, entities with this arrangement have storage capabilities and establish criteria for the distribution of water. It must be remembered, however, that the company is created to serve its shareholders. The shareholder actually owns a piece of the company rather than specific water rights of a certain priority date. The share held does represent an entitlement to a volume of water which may be a fixed amount or a percentage of the total water available that year. The determination of the volume of water (fixed or a percentage) represented by a share may be based upon the acreage to be irrigated, the crops grown, or an amount decided upon by the shareholders. Each shareholder is given the option of purchasing as many shares as he wishes and is capable of buying. Assessments for construction, operation, and maintenance are likewise administered either on a per share or per volume of water used basis.

The stockholders (members) of the irrigation companies have the final control of policies through the vote. Their functions are few but vitally important. They elect directors and may remove them from office at any time. Consolidation with other corporations or unincorporated associations can be done only with their consent. Each stockholder has the right to vote at any election and voting is done on either a one vote per share or a one vote per member basis. Sole responsibility for managing the affairs of such associations or companies is given to a board of directors. This board has the power to formulate policies, make contracts, levy assessments, incur obligations, approve expenditures, and make rules and

regulations for operation of the irrigation system and delivery of water to users. The flow of authority from stockholder to board to company is shown in Figure 2. To avoid dissension the number of members on the board of directors is limited to a small number.[9] The president is usually selected from the board of directors, but, in cases where a vacancy occurs, the position may be filled by the members or stockholders in a special election. Other officers are elected as needed. A manager may be required to supervise operation, maintenance, construction, land forming, and contacts with other organizations.

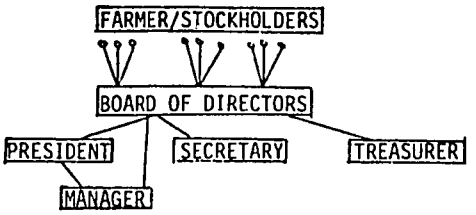
Similar organizational arrangements for local water management exist in Hungary, Germany, Austria, the Philippines, Kenya, Spain, and in many Spanish speaking Latin American countries.[10] The uniqueness of the Spanish local entities will be discussed later in this paper. First, however, the irrigation company concept will be applied to Pakistan as a case study area.[11]

At the outset, it is to be noted that no serious legal impediments exist in Pakistan regarding the formation of water users' organizations. On the other hand, little exists which explicitly encourages such associations. Custom and religion still play a direct role in determining behavior of the small farmer in Pakistan and these factors must be taken into account when trying to implement a new management scheme.

What are equally important are the existing legal provisions which could be used to form water users' associations. The Companies Act of 1913 defined a "company" as "an association of a number of individuals formed for some common purpose." The Act provides that no company, association, or partnership consisting of more than twenty persons shall be formed for the purpose of carrying on any function (except banking) that has as its object the acquisition of gain unless it is registered as a company under the Companies Act or under other relevant acts or charters. Since the clear purpose of a water users' organization is to gain or at least have more water to use for irrigation, this provision seems to strongly encourage formal establishment. The effect of failing to register is to become an illegal company which is a non-entity and so cannot contract or sue to enforce a contract already entered into.

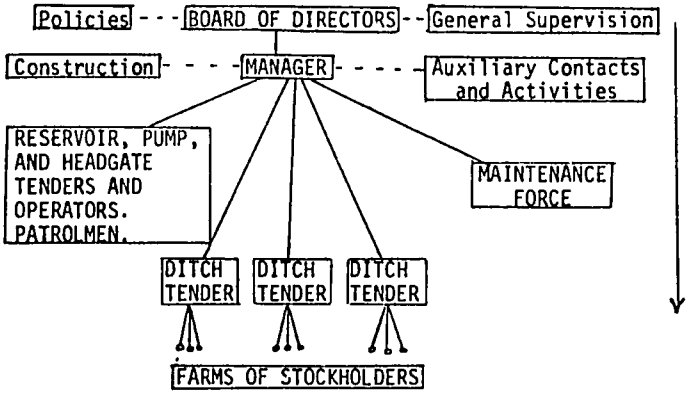
FIGURE 2

ORGANIZATIONAL SCHEMATA AND EXPLANATION*
VOTING CONTROL OF MUTUAL COMPANY EMANATING FROM STOCKHOLDERS**



Flow of Accountability to the Stockholders through the Board of Directors to which the Organization is Accountable

Control of Water Service to Stockholders of Mutual Companies Emanating from Boards of Directors***



Flow of Water Delivery Service to Stockholders

*These charts with general explanations may be found in the Farm Credit Administration pamphlet by Wells A. Hutchins, entitled Organization and Operation of Cooperative Irrigation Companies, pp. 30-31, 1936.

**Note that control of the entire operation begins with the farmer stockholder and ends with delivery of water to him.

***The importance of taking the electoral process seriously is illustrated here. If the farmer/stockholders turn control over to the board of directors without much thought, the entire process if jeopardized. It is here only that the farmer/stockholders have any direct control.

An association which has registered under the Companies Act may issue shares representing partial ownership. These shares are transferable and so become, in effect, "moveable property." Capital represented by shares may be consolidated and di ded into shares of a larger amount than the existing shares and re onverted into paid-up shares of any denomination. Such provision clearly encourage incorporation and facilitate management of capital. This Act provides the legal basis for formation of a mutual irrigation company among farmers on a voluntary basis and allows the flexibility of being multi-purpose as well.

The Cooperative Societies Act of 1925 was passed to facilitate the formation and working of cooperative societies in Pakistan for the promotion of thrift, self-help, and mutual aid among agriculturists and other persons with common economic needs so as to bring about better living, better business, and better methods of production. The Act applies to: 1) "producers societies," which are groups formed with the object of producing and disposing of goods as the collective property of their members, and 2) "consumers societies," which are societies formed with the object of obtaining and distributing goods to or of performing services for their members and customers and of dividing among their members the profits accruing from such supply and distribution.

Only societies registered as cooperatives may use the word "cooperative" in their titles. The Provincial Government may, by special order, exempt any society from the registration requirements in an effort to save time and trouble. Provisions of the Companies Act do not apply to societies registered under the Cooperative Societies Act, and this simplifies administration.

There are many cooperative societies in Pakistan, but usually their orientation is more toward marketing farm products and securing credit and other agricultural inputs. There are no constraints in the law which would prohibit either adding the functions of water management or creating a separate cooperative for this purpose. One limitation to using an existing cooperative is that the geographical boundaries of the cooperative may not coincide with the water use boundaries of the farmers. One particular advantage of the cooperative type of irrigation entity is the existing familiarity by the farmers with the cooperative concept.

Turning back to alternative schemes found in the United States, quasi-private water user associations are incorporated associations organized by actual or potential water users in a specific area who contract with the government to build irrigation works pursuant to reclaiming or improving land. Often, the association is a federation of irrigation companies who wish to pursue a single purpose objective of mutual interest which is beyond the ability of the separate entities to accomplish. The advantage of this form of organization is that it provides a means for many landowners with small parcels to pool limited funds, irrigate their lands, and increase their crop yields. Indeed, such a plan encourages the development of arid but irrigable land which can often be bought at relatively low prices.

Generally, the objectives of these associations are:

1. To provide irrigation in an area where individuals do not have funds to finance such a venture independently.

2. To allow the government to deal with one organization representing all water users in an area rather than having to deal with many users on an individual basis.

3. To provide a responsible organization to manage the irrigation contemplated by a reclamation act.

The organization of a water user association must be in a form acceptable to a governmental arbiter, although the government usually takes no active role in operating and managing the works.

Essential features of the articles of incorporation should include provisions for effecting the reclamation law regarding ownership of the reclaimed area and for guaranteeing repayment to the government for the cost of the reclamation works.

It must be recognized that a water user association of this type is merely a temporary arrangement. All groups of persons using water are, in effect, water user associations. When the governmental agency responsible for overseeing these projects transfers the works entirely to a water user association of this type, the organization is reclassified according to the successor-type of association, such as a mutual company or irrigation district.

The federated water user association has great potential for countries in which small farmers already have or are beginning to organize into entities for distribution of presently available water supplies. Water user associations can serve to pursue objectives common to a group of companies and would function only upon agreement of the companies involved. An association increases the bargaining power of the small farmers and can serve as the fundamental contracting agent for them with the government. This scheme could work particularly well in Pakistan where the Government water conveyance system distributes water into a hydraulically controlled distributary with fixed flow outlets into watercourses serving the farmers. The outlet size regulates the flow to that particular watercourse according to the hectares to be irrigated. Irrigation companies (private or quasi-private) can logically be organized at the watercourse level; water user associations (quasi-public or public) can be formed at the next level of farmer voluntary heirarchy, consisting of all irrigation companies on a distributary. Similar conditions to those found in Pakistan exist in Afghanistan and India, and the potentials for applying the irrigation company and water user associations likewise apply.

The third alternative organizational form found in the United States is the quasi-public and public organization (irrigation districts). These irrigation districts are formed to amass sufficient capital to construct and operate irrigation systems on a larger geographical basis than that covered by irrigation companies. Again the emphasis is primarily upon water delivery and water removal. A distinctive feature of the district is its ability to sell bonds and levy ad vellorum property taxes to raise the money necessary for project construction and repayment.

Formation of irrigation districts can be brought about by a voluntary action of the irrigation community or, occasionally, as a condition to federal and state funding of an irrigation project. A majority of landowners who will benefit from the district activities must vote for formation. Upon approval of the majority of the electors in the proposed district, a board of supervisors or commissioners is elected. This board then completes the formalities of the district's formation.

Initially, districts were formed for the single purpose of constructing water delivery systems and providing proper timing of the delivery, then the functions of drainage and waste water removal were added. Gradually, some irrigation districts have expanded their services to include municipal water delivery. Irrigation districts are authorized by special legislation in most every Western state of the U. S. A. Because of the broader economic effects and general welfare implications of the district, it is advisable that where their creation is determined useful to the rural community, special legislation be adapted to prescribe the functions, powers, and scope of authority.

Spanish Community of Irrigators

The next alternative scheme to be discussed is that found in Spain and in many Latin American countries which have adopted the basic Spanish water law or were otherwise influenced by the agricultural practices of that nation. Typifying the Spanish system is the irrigation system of Valencia, Spain. It provides a model of public local water administration dating from antiquity that is infused with cultural practices. The system of Valencia has been greatly affected by the Moors and still retains many of their water uses and practices. [12]

A system of administration developed to insure that water is delivered in the most equal proportions possible. All irrigators receiving water from a particular canal are equal and have a right to share in the water according to the size of their holdings. When the supply of water is abundant, there is little restriction on the use of water; however, when a scarcity occurs, the principal of proportionality is implemented.

The irrigation system is administered by a unique local entity, the Community of Irrigators. The principal characteristic of this institution is local autonomy in formulating operating procedures and other governing rules along with autonomy in choosing administrative officers. The Community of Irrigators includes all holders of land with irrigation rights in a single canal service area. Even if a man's land is bounded by two canals, he may only draw from one. Only when the course of the canal is changed can a parcel of land be changed into another service area.

The Community owns the water and sees that it is equitably distributed. Three distinct principles pervade the Community of Irrigators in their efforts to provide maximum cooperation through direct administration. They are: 1) the concept of proportional distribution--each cultivator receives water in proportion to the land he irrigates, 2) the concept of individual responsibility to the community for upkeep on the canal and prevention of waste in water use, and 3) the concept of collective responsibility by self-government and management only by the community.

Each land holder is entitled to vote in the Community Legislature or General Assembly. His right to canal water and his share of the Community's expenses for maintaining and operating the canal are measured roughly in proportion to the land that he owns.

The Assembly meets every three years. At these meetings, they vote on changes that have been proposed on canal policies and establish rules and regulations concerning operating procedures, canal maintenance, and other matters for annual operation. Additionally, they vote on any changes in administrative offices of the canal. The Assembly also elects an Executive Committee to conduct the canal's business until the Assembly meets again. The Executive Committee has five to eight delegates, each representing the users of a given lateral zone of the service area, and is headed by the canal's chief administrative officer, the Syndico. In the fertile valley of Valencia, there are eight major canals, thus eight Syndicos.

The Community of Irrigators has a president, vice-president, representatives from throughout the canal system, a secretary, and a lawyer. The President of each community serves as the chief administrative officer or as Syndico. This group serves as a jury to decide all disputes between irrigators on their canal. It also decides if certain crops should not be grown, and, in general, is responsible for the efficient use of the water allotted. The Executive Committee has supervisory responsibility for regular maintenance of the canal, especially annual silt removal, and must make decisions on when the canal is to be shut down for this purpose, who will do the work, and who is to pay for it.

An important feature of the selection of representatives is their geographic distribution. All areas of the Community must be represented. Thus, if four representatives are elected, one must come from the area near the start of the canal, one from the tail end of

the canal, and two from the center area. This ensures equal status to all users in the community.

The Syndico is elected by a majority of the General Assembly for a period of two to four years, though frequently he continues to hold this position much longer by virtue of re-election. The Syndico must be a landowner who works his farm in the canal's service area, but he cannot own a mill that uses canal water. He is the chief administrator of the canal and its properties and has responsibility for the collection and expenditure of all funds for maintenance and operation of the system. He is also the chief regulator of the distribution of water to the supply laterals of the network and ultimately to its farms. He works within the rules established by the Executive Committee but he has considerable discretion in time of drought or water shortage.

The Community of Irrigators system found in Valencia, Spain, can also be found throughout Spain and in many Latin American countries. It may appear to be less formal than some of the user associations in the United States; however, the tradition associated with the Community creates an extremely formal organization.

CONCLUSIONS

Since early times farmers recognized the need to cooperate in pursuing mutual objectives of crop production and the improvement of their quality of life and surroundings. For the large farmers and ranchers, the importance of cooperation may not be as evident, but for the small farmer the added benefit from joint action can move him a little further above the subsistence level. Further, the possibility of recovering from an error in judgement while operating alone is much less for the small farmer as compared with the larger farmer. For these and other reasons, the small farmer needs to assess his productive capacity as an individual and then examine the alternative courses of action available to him, such as working cooperatively, which will enable him to implement improved water management practices and technologies.

One solution that will be of long range advantage to the individual farmer and his hydraulically connected neighbors, is the selection of an appropriate organizational base for cooperation. The spectrum of local water user organizations in the United States

and Spain provide an insight to possible alternatives. These alternatives are indicative of the options available under the laws of these two countries. In most developing countries water user organizations can be formed under existing company, cooperative, or corporate laws, where specific authority is lacking.

The many problems facing the individual small farmer, as well as the continuing need for food and forage production, have nearly exceeded his capacity to operate indifferently or uncooperatively from his neighbors. The benefits to the small farmer that can be achieved through a properly selected and organized form of water user organization are many. Among the major advantages are:

1. The creation of an independent body which performs dual functions: a) planning, construction, operation, and maintenance of the community waterworks, and b) administration of the organizations objectives.

2. Economies of scale can be achieved by the farmers through pooling of human and capital resources for water development and use of presently available water resources.

3. An identifiable element of the community is responsible for water distribution on an informal and calculated basis.

4. The entity serves as a spokesman for the community in seeking government support for development programs, and conversely, it serves as a permanent and responsible body with which the government or others can enter into contracts.

FOOTNOTES

[1]Karl A. Wittfogel, "The Hydraulic Civilizations," Man's Role in Changing the Face of the Earth, Ed: W. L. Thomas and others, (Chicago: The University of Chicago Press, 1956). p. 153.

[2]Clesson S. Kinney, A Treatise on the Law of Irrigation and Water Rights, Vol. I, (San Francisco: Bender-Moss, Co., 1912). p. 103.

[3]Gaylord V. Skogerboe, George E. Radosevich and Evan C. Vlachos, Consolidation of Irrigation Systems: Phase 1 - Engineering, Legal and Sociological Constraints and/or Facilitators, Completion Report No. 52, (Fort Collins: Environmental Resources Center, Colorado State University, 1973).

[4]See Evan C. Vlachos, "Socio-Economic Aspects of Irrigated Agriculture," Proceedings of Seminar on Prospects for Irrigation in West Africa (Fort Collins: Colorado State University, 1972) in which five functions relative to social interaction with water resources are discussed.

[5]For a detailed discussion of the range of organizational structures in irrigated agriculture, see George E. Radosevich, "Institutional Alternatives to Local Water Management," Proceedings of the Workshop on Water Delivery and Removal (Fort Collins: Colorado State University, 1974).

[6]J. B. Pritchard, Ancient Near Eastern Texts, (1950), p. 188, as cited in "Water Legislation in the Middle East," by Abraham M. Hirsch, American Journal of Comparative Law, VIII (1959), p. 170.

[7]W. L. Thomas, The Development of Institutions Under Irrigation, With Special Reference to Early Utah Conditions, (1920), as cited in R. E. Clark, ed., Waters and Water Rights, Vol. I, (Indianapolis, Indiana: Allen Smith & Co, 1969). pp. 143-145.

[8]A. Russell, "Mutual Water Companies in California", Southern California Law Review 12 (1939): 157-158.

[9]Three is obviously the smallest number possible, as provided in Utah codes. However, five are not uncommon as found in Colorado. Larger boards may be allowed and designed to represent geographical districts or special interests.

[10]See Walter Lichem, "The Role of Internal Structures of Local Water Organizations," Background Paper, Interregional Seminar on Current Issues of Water Resources Administration, (New York: United Nations, 1971).

[11]See George E. Radosevich and Craig Kirkwood, "Organizational Alternatives to Improve On-Farm Water Management in Pakistan," (Fort Collins: Water Management Project, Colorado State University, 1974).

[12]See George E. Radosevich, " Moslem Water Law and Its Influence on Spanish Water Law and the Irrigation Systems of Valencia," Proceedings of the Seminario: La Legislación y Administración de las Aguas en los Paises del Grupo Andino, (Logan: Utah State University, 1974).

Chapter IX
New Technologies for Small Farmers: The Puebla Project+

Huntley H. Biggs*

In recent years, development planners and politicians are paying increasing attention to the problems of subsistence farmers who populate the majority of the world's arable land. Under the guidance of CIMMYT (Spanish initials for the International Maize and Wheat Improvement Center), the Puebla Project was initiated in 1967 in Mexico with the express purpose of raising maize yields on small farming operations. During the early years, the results of the Project were so impressive that many observers believed that the riddle of how to extend new technologies to subsistence farmers had been solved. However, more recent results indicate that earlier prophesies have not been fulfilled.

There are two objectives of this paper. First, a description of the key features of the Puebla Project in its approach to the research and extension problem of small-scale, subsistence farming will be offered. Second, the obstacles to further expansion will be examined. It is hoped that this paper will prove informative for planners and developmentalists who view the alleviation of poverty on a widespread basis as the most basic objective of the development process.

PROGRAMS FOR SUBSISTENCE FARMERS

In general, past assistance programs for agriculture have focused on stimulating higher levels of production directly through such means as irrigation projects. The assumption was that

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greater agricultural growth would benefit the entire population. Peter Dorner complains that:

> "International agencies are not focusing their efforts mainly on employment or distributional development priorities. Though there are many difficulties in trying to identify the beneficiaries of various loans and grants, a study of the United Nations Development Programme for the period 1959-1971 showed that the percentage of total agricultural aid directly related to agrarian reform or for helping small producers was: Latin America, 11%; Asia and the Far East, 7%; Africa 8%; and the Middle East 5%."[1]

While agricultural output has grown in many developing countries, rural poverty is still very much in evidence and may be growing, both in terms of the absolute number of persons classified as poverty stricken and in terms of the average standard of living. Typically, development programs benefit the large, commercial farmers. Estimates, by Harlan Davis, of USAID assistance to Latin America between 1962-68, indicate the following division of funds: 50% benefitted commercial, generally large farmers; 15% was oriented to agrarian reform or beneficiaries of reform programs, primarily small farmers; and 35% went to general improvements that benefit both large and small farmers alike.[2]

More recently, developmentalists are stressing the importance of focusing attention on the subsistence farmer. Poverty and underemployment is perhaps most prevalent among persons in this group. As a result a number of programs have been initiated throughout the world, specifically oriented toward improving the standard of living for the small, subsistence farmer. Not only national governments but also international lending agencies are actively participating in this relatively new area of developmental assistance. For example, the World Bank is giving greater attention to programs of "Integrated Smallholder Development," aimed at providing technical advice and marketing facilities, in addition to credit for on-farm development and input purchase.[3] Programs have been initiated in Mexico, Bangladesh, India, Brazil,

Colombia and East Africa. Information concerning the experiences with these programs has been rather sparce.

In 1971, the Agricultural Development Council held a seminar at Ohio State University on "Small-Farmer Development Strategies." A number of specialists who had direct experience with small-farmer programs assembled in order to share their experiences and attempt to outline an analytic framework for approaching such programs.[4] One of the papers presented a classification system for small farmer development strategies.[5] Essentially, there are three types of programs: the integrated approach, the non-integrated approach and the filter down approach. The integrated approach calls for the simultaneous provision of a number of services or activities for small farmers located in a specific geographic region. The Puebla Project is an example of this type of program. The non-integrated approach stresses only a small number of services or activities. Examples of this approach include credit programs, development of cooperatives and community development. The filter down approach includes national development policy aimed at overall agricultural development such as: price support programs, extension efforts, trade policies and research. The problem with the latter approach is that there are no explicit provisions made for the small farmer. Typically, these programs benefit the large commercial farmers who have access to information and are already active participants in the exchange economy. Seldom are the rural poor helped by these programs.

KEY FEATURES OF THE PUEBLA PROJECT

In 1967, the International Maize and Wheat Improvement Center (CIMMYT) launched a program in the State of Puebla, Mexico specifically designed to raise maize yields on small holdings. The program is an integrated program not only involving new production technologies suitable to the needs of maize farmers in this region, but also an appropriate extension strategy for conveying the new technology to a large number of small operators. There are probably a number of lessons to be learned from the Puebla Project that have application to other countries desiring to initiate similar programs aimed at subsistence cultivators.

There are a number of interesting features in the Puebla Project.[6] First, great efforts were made to integrate the research and extension functions. Rather than conducting agronomic experiments in the isolation of an experiment station, the farmers' plots were used in performing the research for developing new production recommendations. In this way, experimental results were obtained under precisely the same environmental conditions confronting the cultivator, thus, shortening the feedback loop to the researcher. On the basis of field experiments in 1967, three basic changes in production techniques were recommended. First, the recommendations called for increased fertilizer applications of a different mix than that used currently. To carry out the new fertilizing recommendations an increase of about 25 percent in the amount of credit was needed. Second, part of the fertilizer should be applied at time of planting with the balance at the time of the second cultivation. The traditional practice was to apply fertilizer only at the first cultivation after the seedlings were well established. Third, the plant population was increased from about 20,000 to 50,000 plants per hectare.

To integrate effectively the extension function with the research component a number of "high-yield plots" were initiated on the farms themselves. These were small areas on which the farmer employed the recommendations under the close supervision of project personnel. Field days were conducted by the participants for the benefit of representatives from the agricultural infrastructure and the other farmers in the region.

A second feature of the Puebla Project is the use of an interdisciplinary team to carry out the functions of research, extension, evaluation and coordination of activities with public and private institutions. While each of the team members is a trained specialist, he also must be capable of working with persons from other disciplines. Generally, the team members are young men, many holding the equivalent of a masters degree. Each seemed to be quite enthusiastic and willing to spend much time in the field with the cultivators.

The third feature is the organization of the extension function. Initially, participants were selected with the advice and assistance of the local leadership. During the first year of extension, 1968, the technical team worked very closely with the

farmers to assure proper execution of the recommendations. However, in order to disseminate information to a much larger number of farmers, it became necessary to develop techniques which economized on the team's efforts and reduced costs per farm family. In 1969, each of four farm advisers was assigned a region. It was his responsibility to form producer groups and to work closely with the group's democratically elected leaders in disseminating the new production technologies. In addition, a number of communications media were adopted. Folios were printed and distributed with the recommended practices for each of the four zones. A sound truck was used to attract the attention of the community's inhabitants and to announce future meetings with project personnel. A radio program was initiated to keep farmers informed as to what to do, at what time. Finally, a sound movie was prepared to explain the recommended practices. Undoubtedly, these innovative approaches to the extension of new technologies to a large number of small operators contributed to the success of the project during its first years of operation.

The experience of the Puebla Project is summarized in Table 1. On the basis of the first two years of extension experience, 1968-69, there was a high degree of optimism expressed by observers of the Puebla Project. Yields were high and participation rates were soaring. With the adoption of the recommended practices, yields could be increased from about 1.5 tons per hectare to 3.9 tons over the traditional technology. To implement the new technology, farmers experienced a 90 percent increase in costs, chiefly in the form of higher fertilizer outlays (166%) and expenditures for animal and labor power (17%). The government agency, CONASUPO, (Compania Distribuidora de Subsistencias) guaranteed a price of 900 pesos per ton of shelled corn at 12% moisture, which allowed farmers a net profit of 1574.50 pesos (US $130) per hectare. This represented a profit nearly five times larger than that possible under the traditional cultivation practices. Based upon the average farm size in the project region of 2.5 hectares, this implies an additional family income of nearly US $250.00 per maiz crop.[7] This additional income represents an increase of 117% in the income derived from crop sales, and 50% increase to total family income from all sources.[8]

Table 1

Puebla Project Area,
Yields, Participation and Credit, 1968-71

	1968	1969	1970	1971
Yields (kgs./ha.):				
1. Participants[a]	3894	2765	2670	2618
2. General for area (including participants)	2091	1790	1917	1883
3. Difference (1 minus 2)	1803	975	753	735
Participation:				
4. Area in high-yield plots (hectares)	95	5642	12500	14438[b]
5. Cultivators	103	2561	4833	5240[c]
6. Producer groups	3	128	218	183
Credit (hundred thousand pesos)	0.75	49.0	96.0	76.0[d]

[a]Participants are defined as those who obtained bank credit for fertilizer purchases. This ignores cultivators who utilized the recommended practices but financed purchases of inputs out of past savings or used non-bank sources for credit.

[b]For 1971, participants accounted for 19% of total area sown in maize and 36% of the total maize production.

[c]It is estimated that the number of cultivators for 1972 is about 5200.

[d]Part of the explanation for the large decrease in the value of credit is due to a 20% reduction in the price of fertilizer from the government operation, Guanomex.

Sources:

1) The above data were taken from charts used by Puebla Project personnel for explaining the project's performance to visitors, except as listed below.

2) Yield data for 1971 from: "Programa de Evaluacion Resultados del Ciclo 1971" (Mimeo. Puebla Project), p. 10.
3) Note b) above: Ing. Mauro A. Gomez Aguilar, "Sintesis de los Aspectos Principales en el Plan Puebla Durante 1971." (Mimeo. Puebla Project), pp. 6-7.

The obvious economic advantage of adopting the recommended practices probably was the major factor in explaining the sharply rising rates of participation in the early years of the Project. However, after reaching a level of 4833 farmers in 1970, participation rates have not grown rapidly. Despite the fact that the number of participating cultivators has increased over fifty times during four years, the number of cultivators in 1971 represented only about one-tenth of the total in the region.[9] The slowing of the rates of growth in participation has given rise to some serious concerns on the part of the Project personnel and persons at CIMMYT. One of the major areas of attention on the part of the newly created Economics Section at CIMMYT is to analyze participation rates. The balance of the paper will be devoted to an examination of some of the problems of the past which must be solved in order to guarantee future progress.

OBSTACLES TO PROGRESS

There are a number of problems or obstacles to extending new production technologies to a large number of farmers both in this region and in other regions of Mexico. Although it is recognized that these problems are quite complex and interrelated, there are three broad categories of problems that can be identified for the purposes of discussion: 1) technical-production problems, 2) organizational and institutional problems, and 3) those related to farmer decision-making. These problems and facts interact to explain why the early successes of the project have been shortlived. It is hoped that an analysis of these problems will help in the formulation of solutions.

Technical-production Problems

A glance at the yield figures (Table 1, line 1) reveals that yields on the participants' high-yield plots fell by 33% between 1968

and 1971. There are a number of variables influencing yields, not in the least of which is weather. Precipitation levels in 1968 were above normal and well distributed throughout the growing season, April to October; however, late rains in 1969 and 1970, as well as generally dry conditions throughout 1971 had a decided adverse effect on yields.

The new technologies, which employ heavy doses of fertilizer and require a doubling of plantings per unit of area, are particularly sensitive to deficiencies in rainfall. When precipitation is below normal, the intense competition of the increased plant population for available moisture actually causes absolute yields to fall. The annual variation in yield (Table 1, lines 1 and 2) was much more evident in the case of the high-yield plots than in the case of the general average for the region. Between 1968 and 1969, yields on the participants' plots fell by 1129 kilograms compared to 301 for the general average. Between 1969 and 1970, yields under the new practices fell by 95 kilos while the average for the region actually increased by 127 kilos. One possible explanation for the latter inverse pattern of yield experiences between the two categories lies in the differences in cultivation practices. The traditional method calls for moderate doses of fertilizer at the first cultivation; whereas the new technique calls for large applications at the time of planting and another at the second cultivation. When rainfall is deficient during the germination period the moisture stress factor probably is much greater with the increased plant population and higher fertilizer dosage. On the other hand, smaller plant populations without fertilizer during the period of germination may lessen moisture stress during seasons when the rains are abnormally late. Applications of fertilizer later in the cycle when precipitation is more, probably will assure a higher level of moisture-fertilizer interaction. This hypothesis is supported by the dramatic decline in the differentials between the general average and the participants' yields during the years of inadequate or maldistributed rainfall (Table 1, line 3).

The experience of the Puebla Project in this regard is not dissimilar from that associated with the development and introduction of new agronomic practices in other parts of the world. It is not unusual to find that new technologies, particularly those requiring increased amounts of off-farm inputs (new seeds and fertilizers) are quite often vulnerable to moisture stress. New technologies developed and field tested under adequate moisture conditions often perform worse than the local technologies when subjected to rainfall

deficiences. Greater efforts in the future are needed to devise more flexible recommendations which can take into account variations in rainfall patterns.

Organizational and Institutional Problems

The new production technology was developed in a relatively short period of time; however, it appears that there has not been sufficient modification of the institutional and organizational structure to support the extension of the new technology to a large number of farmers. This category of problems can be further subdivided into those associated with particular groups and institutions: (1) the agricultural infrastructure, (2) the research and extension team, and (3) the producers.

The agricultural infrastructure refers to the institutions which provide the services necessary to support the introduction of the new technologies. In addition to the extension function discussed below, the key services are the extending of credit and the supplying of fertilizers. In the first year of the project, 1968, the public credit institutions chose not to participate in the project. In that year, all of the credit was supplied by a private fertilizer distributor, Impulsora de Puebla.

Once the merits of the new technology had been demonstrated, public banks decided to participate in the program. While their participation permitted a larger volume of credit, the procedure for obtaining credit was somewhat complicated. Many farmers complained that credit was not available from the banks. A further investigation of this complaint reveals that it is based upon two explanations: one sociological and the other financial. First, there is a tremendous communication gap between the peasant and the bank personnel. The peasant often does not fully comprehend the impersonal contracting procedure for obtaining bank credit. He very often finds the required paperwork confusing and he ends up deciding "no vale la pena" (it's not worth the trouble). This attitude can be appreciated when one realizes the limited contacts that the typical peasant has with various aspects of urban life, particularly those involving impersonal obligations. He may even opt for obtaining credit through a rural moneylender at exorbitant interest rates rather than exposing himself to the frustrations of dealing with an impersonal institution. At the same time, it is no doubt frustrating

and quite time consuming for bank personnel to work with a large number of individuals who are typically ignorant of the procedures for obtaining and repaying credit. The whole borrowing lending procedure becomes an educational process as much as a financial transaction. Equally significant is the fact that many bank personnel, who have managed to attain a position of relatively high social and economic status, may find it demeaning to deal with peasants. Finally, as the number of participants increased, the extension coordinator was no longer able to work as closely with the financial institutions to facilitate credit transactions.

A second explanation for the allegation that credit was not available was financial in nature. In 1970 and 1971, a number of the participants incurred heavy losses due to the poor harvests resulting from the lack of adequate rainfall. Many farmers defaulted on their loans, made for the purchase of fertilizers, which may have damaged their creditworthiness and made it difficult or impossible to obtain credit in subsequent seasons.

There also have been problems with assuring adequate and timely fertilizer supplies. Shortages were particularly acute in 1971 when the government lowered the price of fertilizer creating a sudden surge in demand.[10] In 1972, many farmers did not receive fertilizer in time for the sowing because the local distributor had failed to allow a sufficient lead time in ordering the ingredients from his supplier in Mexico City. Part of the neglect was due to inadequate foresight on the part of the producer group leaders who should have made sure that the orders were placed well in advance of the planting season. Some observers suggested that the previous year's harvest experience was so poor that it was assumed that many farmers would not participate in the Project the next year. Thus, the expected demand for fertilizer would be much below that of previous years, discouraging the local distributor from ordering as much as in the past.

The allegations were made that the fertilizer bags did not contain the appropriate strengths and amounts as stipulated on the labels. It was remarked that the 50 kilo bags actually contained only between 47 and 48 kilos of fertilizer. This means that the farmer was applying four to six per cent less fertilizer per hectare than was recommended. This probably would diminish yields and distort the results of the evaluation survey.

Many of the organization and institutional problems confronting the Project called for strong support from the political leadership for their resolution. Quite favorable reports were given regarding the efforts of key officials at the State level, particularly the state representative of the Secretariat for Agriculture and Livestock. However, there was also a general feeling that there was insufficient support at the national level for programs aimed at the small farmer. This neglect was explained by the fact that the lion's share of the limited amounts of public funds were being channeled to support the industrialization process and commercial agriculture in the irrigation districts.

The second group involved in the organizational problems is the technical team. The team is composed chiefly of relatively young men who have recently completed a bachelor's or master's degree. There can be little doubt about their enthusiasm nor about their level of technical competence. Two particularly impressive facts are: their willingness to work in the field and their candidness in discussing shortcomings of the Project.

On the basis of very superficial evidence, there are three critical observations that are offered concerning the technical team. First, while the number of cultivators involved in the project has increased fifty times, the number of team members has only doubled (see Table 1). Despite the fact that extension efforts were to be facilitated by the formation of producer groups, it only seems logical that some of the effectiveness of the team's efforts would be diluted. It seems, therefore, that either a more effective level of group organization and degree of confidence among the farmers must be generated, or more team members enrolled to permit closer supervision of the farmers.

The Mexican national extension service could be a source of manpower to assist the CIMMYT team; however, there appear to be some problems of cooperation between the two organizations. It was explained that in the initial years of the program the assistance of the national extension service was not solicited to support the Project effort. This neglect bred a sense of jealousy and competitiveness so that in subsequent years, CIMMYT was unable to obtain the cooperation that was needed to extend the effort over a large number of farmers.

One of the innovative features of the project was the use of various mass media to disseminate information about the new technology. Printed pamphlets were made available containing the recommended practices for each zone. Despite the fact that the benchmark survey reported that 77 percent of the farmers considered themselves literate, the average number of years of school is only 2.36.[11] The pamphlets seemed to be rather technical, raising some doubts as to their effectiveness in the hands of semi-literate peasants. The problem of mass communication of new techniques still remains a problem throughout most of the world, and Mexico appears to be no exception.

Finally, as mentioned above, there seems to be no question as to the technical competence of the team members; however, there did appear to be an absence of experience. For example, the problem of how to modify the optimal practices to account for unpredicted moisture deficiency may take a number of years of experience in the field. Such situations are not so easily dealt with solely by textbooks and formal education. Admittedly, finding those rare individuals who have such experience and are keenly motivated to work in the field is no doubt a difficult task.

The cultivators form the third group associated with organizational problems. A number of producer groups were formed with the help of the team to disseminate information concerning the new technologies, to assist in obtaining credit for individuals, and to expedite repayments. One complaint concerning the producer groups was that they were ineffective in conducting business with off-farm service suppliers because they were not legal entities and thus, could not contract as a group with input suppliers. It is believed that the viability of the producer groups was also limited by the fact that the peasant farmer does not like to associate with groups and would refuse to do so even if it means foregoing credit. Forcing participants to join the groups may in fact have limited participation rates. In addition, the groups may limit membership to prospective participants because a single defaulter may prevent the entire group from obtaining credit the following season. These two factors have been offered as explanations as to why the producer groups may in fact limit participation rates in the Project.[12]

On the other hand, another observer has contended that the formation of the producer groups has had a very positive impact on the organizational capabilities of rural communities. These groups

(also called credit societies) have been instrumental in breaking down traditional barriers to agricultural credit stimulating the use of fertilizer technology and creating a group mechanism for other kinds of farm and community developments including community irrigation projects, initiation of livestock enterprises, and truck farming.[13] These are obvious social benefits that should be included in any overall evaluation of the Project.

These are but a few of the many organizational and institutional problems confronting the Project. Despite the dramatic economic advantage offered by the new technology, farmers will not reap the full rewards unless these problems are resolved. The experience of the Puebla Project reiterates an important lesson--innovative efforts in the area of organization and institutional modification to support the new production techniques are as essential for the long-run success of such programs as the creation of the new techniques themselves.

Farmer Decision Making

The final problem area to be discussed is concerned with the individual's decisions regarding the new technology. One set of decisions deals with participation: what motivates the farmer to participate or not, and if the decision is made to participate, what motivates the farmer later to cease participation. A second set of decisions is concerned with how closely the participant follows the recommendations. The latter influences yields and in turn, affect future participation levels. Let us examine each of the decision-making areas.

One of the most important factors influencing the decision to participate or not is the degree of risk implied by the new technology. Fundamentally, the campesino is a risk averter. Even under the possibility of doubling family income, many farmers may be deterred from participation by their perception of the risk accompanying the technology. A poor crop year could jeopardize the family's economic security and wipe out any personal savings, given the heavy investments in fertilizers recommended under the new technologies. As mentioned earlier, inadequate moisture actually diminishes absolute yields where chemical fertilizers are used and plant population doubled. Due to the poor rainfall of 1970 and 1971, many participants incurred heavy debts which no doubt discouraged participation

rates. Experimental data from the Project area verified the farmers' impressions that risk is greater with the Project recommendations than with the traditional practices.[14]

It may be argued that an effective crop insurance program could help to decrease the farmers' view of the risk associated with the new venture and thereby, encourage greater participation. The fact is that the participating farmers were required to purchase Mexico's crop insurance in order to qualify for a fertilizer loan. Some observers, however, felt that this requirement may actually have retarded rather than stimulated participation, because the farmers felt that the insurance did not serve their best interests. This notion reflects the fact that the crop insurance is really loan insurance to protect the lender from farmer default in the event of bad weather. Consequently, a farmer could recover only a fraction of the loss in gross income that may result from adoption of the new technology.[15] Insurance covering the entire crop, not just the loan, would no doubt help to reduce some of the perceived risk attached to the Project recommendations.

The practices recommended by the extension team were economically optimal for each particular zone, based upon agronomic experimentation and certain assumptions about prices and costs.[16] As a result, separate techniques were suggested for each of the five zones. From the standpoint of the extension effort, disseminating a single set of recommendations to each zone is relatively low-cost and easy to accomplish. However, making a number of alternative practices available to the cultivator, allows him to select the one which will optimize his returns given his capital constraint and his evaluation of the degree of risk.

The project personnel realized the significance of the capital constraint and risk factors as well as the importance of differences in soil conditions and planting dates in the decision making of cultivators. Consequently, in 1971 a number of alternative technologies were generated for each of the zones.

There are many cases where farmers participated in the Project but then decided to withdraw. By far the most frequent explanation for dropping out of the program was the accumulation of bad debts from previous years. The major reason given for loan defaults was low levels of production. While weather no doubt played a key role in depressing yields below their maximum levels, there is

evidence that many of the participants failed to follow the recommendations precisely. This would tend to lower yields even in years with adequate rainfall. As the Project expanded to cover more farmers, it became increasingly difficult to monitor closely the practices on each farmer's plot.

Not only do sub-optimal yields cause participants to drop out of the program, but also may discourage further diffusion of technology to new farmers, based on the following logic. Prospective participants observe that current demonstration plots (actually, the participants' own plot) render yields that are less than double their own but do not realize that this can be explained by the fact that the recommendations are not being followed exactly. After weighing the risks against the observed yields, farmers choose not to accept the risk and opt not to participate.[17]

Once the decision to obtain credit for participation is made, how the farmer executes the recommendations is vital to the success of his harvest. One of the recommended changes was to apply fertilizer at the planting and the second cultivation rather than at the first cultivation only, which is the traditional practice. Many farmers were reluctant to apply the fertilizer at the sowing. They argued that they would prefer to wait until the first cultivation, since by that time it can be determined if the rains have been adequate to assure a reasonable crop. If the rains have been too late, the money invested in fertilizer for the sowing would be lost. This approach seems logical under the highly variable rainfall pattern characterizing the region.

A problem closely associated with the preceding one is the difficulty of determining whether the farmers are in fact applying the appropriate mix and quantity of fertilizer at the correct time. For example, many farmers preferred to use the conventional 10-8-4 formula rather than applying 130 kilograms per hectare of nitrogen and 40 of phosphorous as recommended. Part of the reason for this was that the cost of the old mix was much cheaper and secondly, 10-8-4 was a mixture that had been used for a number of years in the region so that the results were predictable.

Another problem is in making sure that the reported quantity applied was the actual quantity. Often farmers would buy the recommended quantities but not apply the entire amount. Some cultivators see the fertilizer purchase as a form of savings to be

sold at a later time when cash is needed. Others would sell part of the total to a neighbor or family member who was not able to obtain credit. Some farmers complained that the increased fertilizer dosage and the necessity of applying it in precise amounts was quite laborious. The stooping to apply the correct amount by hand often resulted in a backache. Frequently labor was hired for helping in the application of the fertilizer at the sowing. In either case some farmers contended that the extra work of applying the new technology was not worth the additional return.

In addition to the above, there are a number of other possible explanations for farmers undertaking practices at variance with those recommended by the technical team. Among these are: late receipt of fertilizer due to late loan applications and difficulty in bank processing them, planting low densities to reduce risk, participants not fully informed on the recommendations, credit constraint in purchasing fertilizers, and farmers find it difficult to judge seeding densities properly. All of these factors combine to inhibit the use of optimal practices.

On the surface, these practices by farmers appear to be irrational given the tremendous returns that could be reaped if they were to follow more closely the recommendations. When analyzed more deeply, however, these decisions seem to be perfectly rational in light of the physical, financial and institutional constraints confronting the farmer. It can be generally concluded that the risk factor plays a very important role in the peasant's decisions to participate or not, and how closely to follow the recommended practices. Clearly the inadequate rainfall in 1970 and 1972 worked to substantiate the riskiness of adopting the new practices. Fairly widespread accumulation of bad debts because of a poor harvest acts as a major deterrent to continued participation and growth in the number of participants.

CONCLUSIONS[18]

In recent years, development experts have been turning their attention to the problem of persistent and widespread poverty. Experience has shown that high rates of production growth are not sufficient to guarantee higher levels of well being for the majority. Sadly, the fruits of economic progress tend to be concentrated in the hands of the well-to-do minority.

Persistent poverty has its roots primarily in the subsistence agricultural sector. Small size and traditional production techniques have placed limitations on production possibilities and thus, family incomes. Nevertheless, the small farming sector can make a positive contribution to the developmental process if the production constraints are broken. In the short run, the solution of increasing the size of the operation is unfeasible for most countries. Introducing new production technologies seems to hold the most promise for raising income levels and encouraging integration of the rural peasantry with the modern society.

In 1967, the Puebla Project was launched with the objective of increasing maize yields among small, subsistence farmers in the State of Puebla. The early successes, which gave rise to widespread optimism throughout the developing world, were not sustained in subsequent years. Many of the problems faced by the Project are shared by developing countries throughout the world which have attempted similar experiments. Generally, the technical production problems are relatively simple compared to those of a socio-economic nature. The success or failure of this and other projects largely will be determined by whether or not solutions can be found to the associated institutional, organizational and social problems.

Perhaps the most significant factor influencing the participation of farmers is risk. The heavy capital investments and the high variability of yields under unpredictable weather conditions cause farmer reluctance to participate in the new technology. Equally significant is guaranteeing the availability of credit and the physical inputs at the proper time, and in the correct amounts. Certainly, a higher degree of organization among the producers themselves may assist in obtaining the financial and physical inputs. The cooperation of various public and private institutions and how these are organized vis-a-vis the Project can contribute toward minimizing the risk attached to these problems.

The most positive results of the Project to date have been derived from its experiences with new organizational techniques in the area of extension and research. The integration of the research and extension functions at the farm level is particularly significant. Farmers can learn immediately about new techniques as they participate in the research itself. This experience should heighten his awareness of alternative production techniques, encourage his confidence in them, and make him more likely to adopt new practices.

Additionally, it makes the researcher more sensitive to the actual conditions confronting the farmer in contrast to the highly artificial ones found on the experiment station.

The problems confronting the Puebla Project should not result in frustration and despair but rather should serve as stimuli for further research and innovation, particularly in the social sciences. The poverty problem must be faced on its own terms, as it is found in the subsistence agricultural sector. It is hoped that successful efforts to raise production levels on these operations will be a first step toward eliminating the dual problems of unemployment and maldistribution of income, the primary sources of persistent poverty throughout the world.

FOOTNOTES

[+]The author was in Mexico, June 5-14, 1972, to observe and report on the Puebla Project. The results of that trip were reported originally in the following technical report: "The Puebla Project: Progress and Problems," CUSUSWASH Water Management Technical Report N. 22 (Colorado State University, July 18, 1973). The majority of the material for this article was abstracted from that earlier report.

[1]Peter Dorner, "Redirecting Foreign Assistance," Land Tenure Center Newsletter (University of Wisconsin, April-June, 1971), p. 1.

[2]As reported in Ibid., p. 1.

[3]World Bank, Agriculture - Sector Working Paper, (Washington, D.C.: World Bank, June 1972), pp. 44-46.

[4]The following is a summary report of the seminar: Dale W. Adams and Walter Coward, Jr., "Small-Farmer Development Strategies: A Seminar Report," (New York: Agricultural Development Council, July 1972).

[5]This classification system was given in the following paper: A.T. Mosher, "Projects of Integrated Rural Development."

[6]For a complete description of the Puebla Project during its initial years of operation see: International Maize and Wheat Improvement Center, The Puebla Project, 1967-69: Progress Report of a Program to Rapidly Increase Corn Yields on Small Holdings (Mexico: International Maize and Wheat Improvement Center).

[7]Ibid., p. 92.

[8]Ibid., p. 18.

[9]Ibid., p. 14.

[10]Mauro A. Aguilar, "Sintesis de los Aspectos Principales en el Plan Puelba durante 1971", (mimeographed for Puebla Project), p. 3

[11]International Maize and Wheat Improvement Center, The Puebla Project, p. 17.

[12]Don Winkelmann, "Factors Inhibiting Farmer Participation in Plan Puebla," Land Tenure Center Newsletter No. 39 (University of Wisconsin: January-March, 1973), pp. 4-5. This article is based on a paper entitled, "Plan Puebla After Six Years," presented to the Ford Foundation of OLAC Program Advisors in Agriculture, Mexico City, November 6-10, 1972.

[13]Herman Felstehausen, "The Puebla Project: An Additional Perspective," Land Tenure Center Newsletter No. 39 (University of Wisconsin, January-March 1973), p. 7.

[14]Winkelmann, "Factors Inhibiting Participation," p. 3.

[15]Ibid., p. 4.

[16]International Maize and Wheat Improvement Center, The Puebla Project, p. 45.

[17]Winkelmann, "Factors Inhibiting Participation," p. 4.

[18]Many of the conclusions reached in this study are confirmed by another observer in the following: William I. Jones, "Mexico's Puebla Project: Is there Hope for the Minifundistas?" International Development Review 14 (Second Quarter, 1972), pp. 21-25. For a reply to the former see: Delbert T. Myren, "Potential in the Puebla Project," International Development Review 15 (First Quarter, 1973), pp. 21-22.