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# PROGRESS REPORT

CONTRACT NO. AID 2163

WITH IOWA STATE UNIVERSITY

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## INTRODUCTION

This is the third progress report for research contract No. 2163 between the Agency for International Development and Iowa State University. It includes three parts: (1) a summary of individual research problems which are complete, (2) a brief review of research projects which are substantially well along toward completion, and (3) an outline of potential areas of research which have been defined and are ready for review and revision by personnel of AID/Washington.

The individual projects included under this contract focus on the total set of considerations involved in food shipments under Public Law 480 as Amended in 1966. These considerations include domestic and foreign aspects, agricultural and industrial development, and theoretical and practical economic analysis. While the total set of considerations is important for any decisions on individual food shipments, yet in applying research tools to the broad problems involved, the areas must be divided in order to isolate specific affects through use of the methods of scientific analysis. To accomplish this end, we have isolated the following broad areas of inquiry.

One area of inquiry involves developmental aspects of food shipments. Studies in this area analyze effects on national levels of production and productivity of recipient countries. A second area of inquiry involves welfare aspects. Studies in this area analyze effects on individual recipients of food shipment within recipient countries. A third area of inquiry involves the measurement of various kinds of effects on the donor country and in particular its agricultural sector.

A fourth area of inquiry studies the terms of trade of food shipments and effects on price levels of recipient countries. There are other areas which need further study: what particular types of projects in recipient countries could be carried out using food for work; how can food aid be used to reduce the inequities resulting from economic development and contribute to the general welfare of the recipient nation; finally, what proportion of aid to a country can be made up of food aid and what proportion must be monetary aid -- especially at different stages of development.

Food aid is a special kind of aid -- sometimes descriptively titled aid-in-kind and other times titled tied aid. Whichever title is given, it implies a shift of resources in non money terms from the United States to other countries. The aid can be looked upon partially as investment and partially as welfare improvement. Investment aspects involve creation of employment, expansion of productive capacity, inflationary or deflationary impacts, growth in consumer welfare, and finally potential improvement in the standard of living. Welfare aspects are more direct and relate to effects on individual consumers of marginal units of food, the effect on his consumption patterns, the effect on his work patterns, saving patterns, real income level, educational attainment and contribution to the productive capacity of the nation in which he lives. These aspects are interrelated since investment eventually affects welfare levels and similarly direct additions to welfare levels affect the level of investment through real income and saving effects.

These various phases of the project are included in studies completed or presently underway with the project. The proposed areas of study define additional problems within the broad overall project outlined initially.

#### Research Projects Completed

The following research reports have been completed:

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| 1. Uma K. Srivastava                                   | Impact of P.L. 480 aid on India's money supply and balance of payments position: a look ahead                                       |
| 2. Leo V. Mayer  | An analysis of costs incurred and prices charged for food shipments under Public Law 480.   |
| 3. National Council of Applied Economic Research       | Demand and supply projections of food grains for India, 1971-1986.  |
| 4. Walter W. Haessel                                   | An intersectoral model of Agricultural development for a dual economy.  |
| 5. Lee Blakeslee, Charles Farmingham and Earl O. Heady | Projection of World Food Demand and Production Potentials (Including Land Available For Development) and Inter-Country Distribution |

The first three reports are available in preliminary form and will be submitted in final form after review and revision. The fourth and fifth reports are still in the process of interpretation and editing and will be available in late Fall, 1970

#### Projects Near Completion

Three additional projects are well along toward completion. These three projects are substantially more comprehensive and are requiring a somewhat longer period of preparation.

#### Weather fluctuations, food grain production and buffer stocks for India

This study relates food grain production to weather through use

of multiple regression analysis. Production is expressed as a function of controlled variables (fertilizer, pesticides, irrigation, prices, etc.) and uncontrolled variables (rainfall, temperature, length of monsoon season, etc.). For the latter variable, data from 136 weather stations in India are available from 1875. These data combined with data on production inputs will provide a basis for estimating production for future periods. These estimates and their expected variation will allow for measuring the gap between supply and demand under assumptions of adverse weather conditions after which the work will focus on the level of buffer stocks required to prevent food shortages.

The project is moving along well and base material is available for the following sections:

- I. Introduction
- II. Imbalances, Instability and Government Operations in Food Grains
- III. Fluctuations in Prices: An Analysis of its Causes.
- IV. Causes of Instability in Food Grain Production.
- V. Long Term Perspective: Demand and Supply of Food Grains.
- VI. Long Term Perspective: Variation in Demand and Supply.

The remaining sections of the study are in the stage of development and will come together in the next six months. These include:

- VI. A Strategy of Buffer Stocks.
- VII. Size and Composition of Buffer Stocks.
- VIII. A Decision Model for Establishing Buffer Stocks.
- IX. Buffer Stock Location and Storage Problems.

Factors affecting agricultural growth and development in less-developed areas

Preliminary to a specification of a micro-oriented, conceptual model of agricultural development, various components of agricultural production processes are discussed in detail. Where possible, theoretical applications are given documentary support as such support is found in the literature. The review of a large amount of the literature in this area, and the consequent need to secure these materials through interlibrary loans and through purchases from foreign institutions have delayed the completion of certain parts of the study. Upon receipt of these items, a completed first draft will follow shortly.

The introduction is designed to place the problem in perspective, i.e., the role and importance of changes in the agricultural sector on general economic expansion. The chapter on land tenure will provide previously unpublished estimates of the potential for increasing the cultivable area in a number of developing countries. The general theme throughout the study, which is brought out most forcefully and systematically in the chapter which integrates the various components of the agricultural infrastructure, is that the various factors affecting agriculture processes are highly interrelated. For example, improved technology is not feasible to those producers lacking the financial capacity to obtain these inputs. Even where financial means is not a limiting factor, insecurity of tenure may inhibit adoption. Abstracting from financial capacity and tenurial arrangement, adoption may not be economically feasible because of marketing and transportation costs which

absorb much of the producers' potential returns. Of course, another consideration is that of producers' objectives and the extent to which these are affected by developmental processes. Consequently, economic change or government intervention favorably affecting one factor may be stifled because of the stronger, contrary influence of other factors, both economic and social.

The conceptual model elucidates a number of these interrelationships. The principal method employed is that of tracing the evolution of a hypothetical, subsistence-oriented producer toward a market-oriented individual where the latter is responsive to changing economic conditions, both evolutionary and induced by public intervention. The need to obtain necessary materials for a more comprehensive discussion of certain factors than initially planned suggests that a completed report for AID will not be available until February 1, 1971.

Interrelationships of Consumer and Producer Behavior Patterns and Developmental Effects of Food Aid

The focus of this project is on the conditions under which surplus food can be utilized as an instrument of foreign assistance to promote economic development and raise general welfare conditions in the recipient country while avoiding negative impacts on prices and production in the recipient country. The first section analyzes the multiplier effects of developmental investments on national income, private savings, government tax revenue, demand for food, and demand for nonfood goods and services to countries with alternative levels of average per capita income. Supplying food aid in amounts just equal to the additional derived demand resulting from increased investments

results in a simultaneous shift in total food supply and demand so that domestic prices will be unaffected. The study indicates that derived demand for food resulting from development investments is inversely related to the per capita income level of the recipient country. The inverse relationship implies that the portion of investment which can be financed with food aid without disrupting domestic food prices decreases as income levels increase.

The second section of the study involves development of an econometric model to measure the impact of food aid inputs. The model provides for a quantitative analysis of the general case of demand expansion through market segregation. Evaluation of coefficients of a model based on Indian data reveals that under certain marketing schemes food aid distribution has little effect in reducing demand for domestic food products and consequently little negative effect on prices and domestic production. Given the appropriate scheme for segregating the food market total demand expands sufficiently to absorb food aid shipments while minimizing any negative impact of food aid.

The third section concentrates on alternative promotion and subsidization schemes which will provide for lower consumer prices while maintaining domestic production. Analysis of producer response to price incentives in developing countries provides the basis for designating development projects which utilize food aid to promote production. The final section of the study involves integration of alternative distribution methods with associated consumer and producer responses and a translation of these into principles and policy implications which will

assist in programming food to meet specific development objectives.

Currently the study is nearing completion. With the conclusion of sections on empirical tests and analysis, a preliminary draft of the study is expected to be completed by the end of December.

#### Future Research Possibilities

The project reports which are completed or nearing completion provide a basic framework for analyzing developmental aid under Public Law 480. These reports cover a broad spectrum of considerations in food aid shipment - appropriate prices to be charged by the U.S. given domestic farm programs; effects on monetary supplies and inflationary tendencies in recipient countries; and the broad production and welfare impacts of these shipments. The research completed also gives additional evidence to judge the future possibilities for exports under P.L. 480 programs - including the prospect for food balances in India over the next 15 years and the prospects for establishing buffer stocks of food grains to prevent a recurrence of the shortages of 1965-66 and 1966-67. These studies provide a solid base of economic logic and analysis for considering all the many different interests and concerns involved in food shipments.

While the studies undertaken to date represent a sizeable amount of economic application, there are many issues remaining to be analyzed. For a number of years, the question of economic impact on third country exporters has been discussed and analyzed. Most of these analyses have looked at one other country and in general these were other developed countries. But a major question remains over the effect on less developed

countries of changes in export policies from the United States and other developed countries. This area of inquiry represents a potentially large research effort because it will require a framework for analyzing trade effects in an international framework. It could require a multi-country model with trade relationships related to the domestic agricultural sector. Ideally such a model could related changes in trade policies of any one country to the trade results for n-other countries. Changes in agricultural export levels of each country could be related back to general economic growth and development of that country. A major step could be taken toward improving understanding of the international interrelationships of trade, capital movement, price level changes and institutional restraints to resource mobility. These issues are important in implication for improving international trade policies and policies for world wide development.

A second area for further study is the specification of interrelationships between various sectors of underdeveloped economies. One study of a theoretical nature has been completed and specified the major economic relationships for a five sector economy. Further work is required to apply to a specific country situation a model which allows measurement of how an economy changes over time as development progresses. Once this set of relationships is established, the implications of various kinds of aid could be analyzed for their effect on particular sectors of the economy. From this type of analyses could come estimates of appropriate proportions of various kinds of aid required for different stages of development. Food aid could be analyzed for its contribution to countries in initial stages of development, in stages after takeoff,

and for more mature economies.

Another type of project under discussion relates to the creation of new technologies for farmers. For some years the U.S. has been involved in assisting nations to develop university research capabilities in food-short nations. Some of these same nations have shown substantial rises in production in recent years and belatedly the questions of distribution of benefits has come under discussion. These discussions point up the lack of considerations of post-creation type difficulties of new technologies. There are many questions unanswered about adoption rates among farmers with differing levels of access to credit, the appropriate factor shares from new innovations, the means by which increased output is turned into larger investment and more employment and finally how consumer welfare is to improve in instances where farm prices are held constant over time by government policies. Each of these several aspects need to have economic logic and analysis applied in order that an improved understanding may result.

Problems revolving around the distribution of the benefits of agricultural progress are posed for many countries. India represents an opportunity for a detailed study of these facets of development. Hence, a specific study is proposed for this country. The distribution of development and its benefits may be affected by the crops and regions for which technical innovations are developed, the availability of resources and credit to farms of different sizes, the nature of technical improvements and whether they are land-substituting, labor-substituting

increase the demand for labor, the amount of research and availability of resources to farmers in rain-fed and irrigated areas and other patterns relating to public expenditures in development. We propose to obtain sufficient survey data from India to allow empirical indication of these effects over the past decade. However, we also propose to develop general models of development designed to incorporate equitable distribution of the benefits of progress. Previous models and theories of development almost emphasize growth in G.N.P. as the sole goal of development. We propose to examine models in which minimum restraints on employment and income for various regional income and population strata are included and to compare the implied effects on development with other policy alternatives which give positive weights to both the growth and distribution might be used to better guarantee simultaneous attainment of these goals.

Major advance in agricultural productivity and food supply over the last decade have come from adapted high-yielding varieties and associated practices of fertilization and plant protection measures. These advances have been greatest generally in regions of ample rainfall or adequate supplies of water for irrigation. This practice bundle has already brought a large thrust in increased food output. Following wide-spread extension of high-yielding varieties and associated practices, the next large possibility in greater food production appears to be in improved water management and multiple cropping. Hence, we propose to examine the possibilities of these further developments, with special models which relate to improved water use and management and multiple cropping.

as means of extending the time dimension of land use and agricultural productivity. Improved water use and efficiency is greatly restrained by pricing and distribution policies, externalities among farmers and villages in water use, lack of knowledge on water supplies and technologies, etc. Food aid possibilities can be incorporated into these analyses through consideration of Title II projects.

Several other specific problems of agricultural development pose the need for special studies. One of these is in the area of agricultural credit. Most developing countries have public institutions to increase the supply and lower the price of agricultural credit. However, it is almost typical that these programs operate ineffectively in supplying small farmers with credit and thus in speeding the transition from subsistence to market operations. Similarly, low-cost credit through public mechanisms often moves to larger commercial operators while small-scale semi-subsistence operators must rely on high-priced credit through the private market. Another particular problem of development is that of policy implementation and administration. This is a study proposed for some more distant times and would consider elements of manpower training, models of implementation and a detailed specification of policy for development. In the same framework, there is need for a specific study of the interrelationships of agricultural policies of developed countries with those of developing countries.

The many activities which the U.S. encourages in underdeveloped countries required a constant quantity of on going research in these

areas so that programs may be improved, expanded or terminated depending on the outcomes over time. This project expects to continue analyzing these kinds of issues and providing the best answer possible given time and data limitations. We shall attempt to investigate the most pressing problems so that payoff from the research support given by the Agency for International Development will be maximized.