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AGRICULTURAL DIVERSIFICATION AND MARKETS IN THE PHILIPPINES

1. The Bureau of Agricultural Economics (BAECON), Department of Agriculture and Natural Resources, Government of the Philippines.
2. University of Philippine College of Agriculture (UPCA).
3. Economic Research Service (ERS) of the U.S. Department of Agriculture.

First Annual ~~Progress Report~~ and Plan of Work
June 30, 1973
to the
Agency for International Development

1. Outline Summary
2. Fuller Description

June 19, 1973

AGRICULTURAL DIVERSIFICATION AND MARKETS (ADAM) IN THE PHILIPPINES

I. OBJECTIVES:

A. To develop the economic data and analysis needed to identify realistic agricultural production and market opportunities and alternatives at the farm, regional, and national levels; and,

B. To obtain an integrated picture of agriculture within which various policy goals can be analyzed. These can be broadly stated as:

1. Achieve self-sufficiency in agricultural products at least in regard to staple commodities such as rice and corn;

2. Increase national income, raise income of rural people and increase employment in agriculture; and,

3. Improve foreign exchange position by reducing agricultural imports and increasing agricultural exports.

C. To develop in the Philippines the capacity for continuous analysis and re-evaluation of these opportunities and alternatives as production and market conditions change.

II. CONCEPTION OF THE PROBLEM:

A. Initially, in 1970-71, a second generation Green Revolution problem. What to do after rice self-sufficiency reached?

B. Recent emphasis--What are the constraints holding down expansion in rice, feedgrains, and livestock? Employment possibilities and mechanization.

III. ACCOMPLISHMENTS:

A. Bibliography of research done in Agriculture in the Philippines seven volumes published which was used by the new Philippine Council for Agricultural Research (PCAR) as basic reference for preparation of their program.

B. Analysis of Green Revolution Progress on Philippine Farms--Sixteen-page report based on BAECON's 1969-70 sample survey. One-page summary (p. 5 below) stresses widespread adoption of HYV, but restricted application of fertilizer and chemicals. Most farmers using fertilizer got relatively low response in yields. However, one-fifth of the farmers adopted good practices, and got good yield response, averaging nearly 100 cavans (4.5 metric tons) of palay per hectare--twice the average of the other four-fifths of the farmers adopting HYV on irrigated land.

C. Also distributed at PCAR was a paper by Jess Alix giving a preliminary look at Philippine agriculture.

D. A review of literature has been completed by the ADAM staff and a draft has been reproduced.

IV. POLICY OPTIONS:

A. There are three broad policy directions or paths which can be followed to achieve the goals listed in I.

1. Intensification of agricultural production to achieve optimum yields.

2. Diversification to production required for self-sufficiency and large export.

3. Modernization through adoption of new technology and mechanization. (It is implied that only limited expansion of new land cultivation is feasible as compared with the continued rapid population growth.)

V. RESEARCH AGENDA:

A. Analysis of trade-offs among objectives and policies. Quantitative estimates of the extent and nature of these trade-offs are needed. For example, the achievement of self-sufficiency may be at the expense of increasing exports and thus force a curtailment of essential imports. There may be a trade-off between increasing farm income and aggregate production. Also, there are likely to be shortages of adequate markets, capital, foreign exchange or labor; again, quantitative estimates of the effects of these limitations on attaining policy goals need to be obtained.

B. Establishing optimum allocation of and priorities for use of resources.

1. It is necessary to have an organized framework within which to analyze the relationship between objectives, policies, and other relevant variables such as production, consumption, and prices.

2. The analysis should provide guidelines for priorities based on optimum use of resources at the farm level.

C. An effective means of organizing the analysis into a formal planning technique is through the use of a linear programming analysis.

VI. SCHEDULE OF RESEARCH RESULTS:

The overall analysis is being done in parts, each of which will be issued in a series of preliminary reports.

A. National Policy Analysis - Supply and Distribution

1. Interregional production-marketing analysis for rice to be completed within 4-6 months (1-crop Linear Program).

2. Extension to include corn and livestock as well as detailed information from delineation of homogeneous agro-economic areas within 6-8 months from now.

3. Complete representation of the majority of Philippine agriculture during the following year. (Multiple-Product L.P.)

B. Micro-Farm Level Analysis

1. Optimum size farm analysis of the size farm that can be operated with family resources only. Draft expected in 6-8 weeks. (L.P.) A simple study begun before we arrived; preliminary computer runs are being made.

2. Analysis of the effects of uncertainty on farm income. Test of a procedure developed by ERS; results expected in 3 to 4 months.

3. Analysis of integrated agricultural survey for rice wet season 1971 on a regional basis for developing relationships between yield, fertilizer, and chemical use. Some results expected 6-8 weeks. Additional results in 3-4 months. (Cross-section regression)

C. Demand-Price Agricultural Sector Analysis (Proposed)

In place of the brief, general analysis that had been planned, a more quantitative regression treatment is proposed that will be complementary for planning agriculture. A draft would be completed within less than a year after the work is begun.

Data Note:

We have good data for rice, especially irrigated paddy, where HYV is important. We have fair data for corn, with new disease-resistant varieties in limited field use, and for sugar. The data are less adequate for coconuts, although several system-combinations, with other crops and livestock have been reported, livestock, other feedgrains, including soybeans, fruits and vegetables. Some reports are available on each of these commodities, and a few have budget data. For options not now in wide use, we will use experimental data, demonstration results, farm management association records, and foreign country coefficients for new crops. In short, the hard data will be supplemented by synthesized data for the relatively new options.

SOME EXPLORATIONS OF THE NATURE OF THE GREEN REVOLUTION IN THE PHILIPPINES*

Summary

About half of the lowland rice area in the Philippines was planted to high yielding varieties (HYV) in the crop year 1969-70. Yields averaged 20 percent higher for HYV than for other varieties in the irrigated area and about 10 percent higher in the non-irrigated lowlands. In the irrigated areas in the principal (wet) season, one-third of the farmers growing HYV used no commercial fertilizer and one-third used no chemicals for weed, pest, and disease control. Those using fertilizer applied an average of 32 kilograms per hectare of nitrogen plus phosphorus for both HYV and non-HYV growers, about one-third the recommended rate for irrigated HYV. The calculated yield response from fertilizer was relatively low, and farmers reported paying prices appreciably higher than published market prices for fertilizer. As a consequence, the calculated profitability for fertilizer usage and the optimum rate were lower than most previous estimates. Differences in fertilizer usage accounted for little of the variation in rice yields; more research is needed to find out the constraints that are preventing fuller exploitation of the yield potential of HYV.

* This report is from the Agricultural Diversification and Markets (ADAM) Project in the Philippines, cooperative research by (1) Bureau of Agricultural Economics of the Philippines Department of Agriculture and Natural Resources, (2) University of the Philippines College of Agriculture, and (3) ERS, USDA, sponsored jointly by AID and the Government of the Philippines. Many people in these agencies contributed to the collection and processing of the data used, and helpful criticisms were provided on an earlier draft of the paper. L.A. Paulino, Jesus Alix, E. Abarientos, Randolph Barker, Frank Sheppard, and Kenneth Smith, all working in the Philippines, were especially helpful.

ADAM PROJECT

A major aim is to compare resource costs and benefits of alternative crop and livestock patterns that are feasible with present resources and technology available for the Philippines. Agricultural policy has several aims, such as attaining self-sufficiency and increasing exports, maximizing production and growth of agriculture, maximizing farm income, and maximizing contribution to agro-industrial growth, maximizing employment, helping small farmers and improving income distribution, and these aims are sometimes conflicting. An appropriate format for handling these problems is linear programming, with such of the goals as can be formulated each solved in turn. Then the trade-offs between the goals can be assessed. Especially important is the resource requirements of meeting the various goals, so that the announced aims can be related to the provision of the essential inputs.

As the new rice technology was introduced beginning in 1966-67, the far higher yield potentials promised the attainment of self-sufficiency and pointed to the need to shift resources to the production of other commodities. What could be grown and sold besides rice and corn (the second-generation problem)?

More recently a series of disappointing harvests of both rice and corn have focused attention on the constraints that are holding down the production of rice and corn (the 1st generation problem). How to exploit more of the potential of the green revolution?

The objective during the next phase of the project is to lay the foundation for the development of a production marketing analysis system. The main goal is to obtain estimates of production and resource use under alternative government policies and various economic and natural conditions.

The major components of the system are indicated in the schematic diagram. The major focus during this phase of the project will be to concentrate on building a consistant data base, develop several representative farm level models and put together a preliminary policy planning model which will have two or three regions described in detail and the rest of the country only sketched out to the extent current information allows.

NATIONAL POLICY ANALYSIS:

The objective of this portion of the research is to obtain an integrated picture of agriculture, to analyze policy options, and to indicate the most efficient allocation of the economy's limited

resources. Without such integration decisions for the efficient allocation of the economy's limited resources cannot be made for the various programs. The existing programs which are summarized in table 1 and those that will be planned will be considered together as a particular policy mix to determine the most efficient use of the country's resources in attaining the specified policy goals and objectives.

The Planning Approach:

The different crops mentioned in table 1 are grown in the various parts of the country. It will be necessary to delineate homogenous agro-economic areas based on environmental and economic factors. This will allow us to identify areas within which only particular types of crops and other agricultural activities can take place. When the delineation of these areas is completed, it will be possible to identify existing and potential patterns of agricultural production on a regional basis for the whole Philippines. However, because this is a time consuming process and some of the information needed is just being developed, it is necessary to approach the analysis in a sequential manner. The overall goal is to be able to analyze the majority of the agricultural sector in sufficient detail to obtain probable adjustments in production patterns; resource requirements; and marketing, transportation, and processing needs at the national, regional, and farm level.

Procedure:

The general analytical framework will be a production-marketing model. In the final model, each homogenous agro-economic area will be represented by a set of production activities that are suited to it. These areas will then be linked together through transportation, marketing or processing activities on a regional or national basis.

The potential production of all crops, livestock, and inland fisheries will be related to both domestic and export markets and the optimum mix determined by linear programming. The analysis will take the form of describing a recent period for which we have data, perhaps 1971-72 crop year. A projection of an equilibrium situation a few years hence will then be made with a consideration of the policies required to achieve the national goals. For practical purposes and for making the required projections of population, income and demand, we will need to select a specific time period that will be useful for planning purposes, perhaps 1980.

Since there are various goals such as maximizing farm production, maximizing employment, maximizing contribution to gross national product, and perhaps distributional effects, more than one objective function will be considered, since only one thing can be maximized at a time in such an analysis.

TABLE 1

Commodity	Policy Objectives
A. Production of Staple Food 1. Rice 2. Corn 3. Sorghum	- Self-sufficiency in order to conserve foreign exchange
4. Meat a. Poultry b. Swine c. Beef and Carabeef 5. Fish 6. Fruits and Vegetables 7. Other Crops	- To increase farm income of small producers
B. Industrial Raw Materials 1. Feed grains a. Corn b. Sorghum 2. Cassava 3. Other crops such a. Wheat b. etc.	- To support the industrial needs of agriculturally based industries (food mills, processors, manufacturers) for creating employment opportunities and at the same time, conserve foreign exchange
C. Production of Export Crop 1. Traditional Export Crop a. Sugar b. Coconut	- To earn foreign exchange needed for development
c. Pineapple d. Banana e. Logs and lumber f. Abaca g. Tobacco	- To provide employment opportunities
2. Potential Export Crop a. Papaya b. Mango c. Melon d. Castor oil e. Palm oil f. Rubber g. Garlic and other spices h. Sunflower	
3. Processed Export a. Canned b. Dried c. Dehydrated d. Etc.	

The model will not be developed in its entirety at first, but only selected portions with limited detail. Thus, we will begin by developing an interregional model of a commodity system. Because of its importance to the Philipppines, we will begin with rice. It will be possible here to make use of a model developed by Meyers, which programmed rice production in Central Luzon. 1/ The analysis will be developed along similar lines in other regions. In addition, processing, transportation, and marketing activities will be added.

Each of the 10 or 11 regions will have irrigated 1-season and 2-season, rainfed, and upland areas with 3 to 6 variations. This means there will be 5 to 20 activities for each region, for a total of about 175. In addition, an equal number of distribution, marketing and processing activities will be required bringing the total to approximately 350 activities. The matrix would have about the same number of rows; i.e., be about square. This relatively small matrix has the advantage that it can be completed in 2 or 3 months, before we have finished our delineation of homogenous areas, and it will make possible some analysis of rice goals.

Once this problem is set up, it is possible to extend the analysis. This will be accomplished in two ways: (1) additional commodities will be added; and (2) more detailed specification of the resource base of regions gained by the delineation of homogenous agro-economic areas. Thus, three or four months following the development of the rice section of the model, it should be possible to add another set of commodities, probably corn and livestock, as well as detailed information for the pilot region, that has homogenous agro-economic areas delineated.

The Data Base:

During Phase I and Phase II, the Project ADAM staff has assembled data such as climate, soil, infrastructure, etc., by province and by region. These are now being evaluated for their adequacy and being integrated for use in developing homogenous agro-economic areas. Given the present availability of staff, it is not possible to work in such detail on all regions of the country. Thus, two regions, Central Luzon and Southern Luzon, are now being used as pilot regions for the delineation of homogenous areas within the region. Once these areas have been adequately delineated, existing data will be related specifically to each area, where possible.

The working hypothesis is that the majority of the agriculture in a region can be represented by relatively few homogenous agro-economic (HAE(s)) areas. Thus, the delineation of the HAE areas forms the

1/ Meyers, William H. Alternative Pattern of...

underlying basis for developing the more detailed analysis that follows and we must move as rapidly as possible to complete this work for all regions. It may be possible to obtain some additional expertise in this area from Fred Cooke of USDA/ERS on a TDY basis, who has a great deal of experience in this kind of work.

In order to show the economic advantages in production for a given enterprise between each resource situation used in the analysis it is necessary to develop input-output relationships. This should relate to the different levels of technology available for each enterprise and reflect technology that is currently available. Sources of information for this are a recent cost of production survey on rice and corn by BAECON; special surveys by IRRI, UPCA, BAECON and Ateneo University; the Integrated Agricultural Survey by BAECON for yield levels; and the 1971 Census of Agriculture if it becomes available soon.

Micro-Farm Level Analysis

The objective of this portion of the research is to isolate the impact of policy and other variables on the individual farmer as well as to see how much of the new inputs and what combinations are profitable with Philippine response coefficients. Work by the research division on another study concerning the optimum size farm in relation to land reform is being integrated with the work at ADAM.

Optimum Size Farm.--This is a normative analysis of the optimum size farm under varying conditions again using linear programming. Originally, the farm firm was assumed to use family labor only, but had year-round irrigation, with varying planting season for rice and more than a dozen other crops. Labor was the only constraint. The results were that 27 activities came into the solution, some with minute area (e.g., .05 ha.); the farm size that maximized farm income was found to be 3 to 4 hectares of cropland.

The analysis is now being made for a palay farm under conditions of good year-around water control for a one-year crop plan. A total of 24 planting periods are considered, with short-, long- and medium maturing varieties. Upper and lower levels of family labor supply are considered. A land constraint is also introduced and varied parametrically from 0.5 to 7.0 hectares. Other variations are introduced: (1) hiring of transplanting and harvesting labor, and (2) hiring additional animal power. Successive modifications consider varying combinations of animal and machine power for land preparation. The first computer runs on this were arriving in late April. Some results should be available in the next few weeks.

The final step will be to extend the analysis to include the concept of a compact-farm and the "food-bowl" and perhaps compare these with a landlord operated group of tenants on the same size of

farm (100 ha.). These are either variations on the land reform plan (the compact farm) or alternatives ("food bowl" and the landlord operated farm). The compact farm is a semi-cooperative, composed of 6 to 25 farmers, with 10 to 50 hectares of rice paddy, not necessarily all contiguous. A critical ingredient is that the farmers do not have title to the land--they may be tenants or leasees--but they jointly sign and guarantee each other's loan to a rural commercial bank which furnishes them their full credit needs at a low institutional rate (partially subsidized by discounting from the Central Bank) and provides supervision. AID/Manila and the Philippine Government are trying out the compact farm concept as a method of providing workable credit for tenants or former tenants who had previously borrowed from non-institutions, usually the landlord, and also as a way to speed up modernization. Additional extension and supervision is now provided by the regular extension agency (APC) and the Department of Agriculture (NFAC) on farms in the Bicol region. The farmers buy their fertilizer together, and get a discount and delivery, and possibly cooperate in marketing. In the area we visited, the bank was only interested in farms with adequate irrigation for 2 crops, and the farms we saw had full water control with diesel well pumps. The farmers were following advanced technology, and getting very high yields (4 tons paddy/ha.)

The old government program for small farmer credit (ACA) which has been under trial since 1951 is being phased out, as repayment of loans has been too poor. The program was not effective in stimulating the adoption of improved practices. Since the farmers are being "liberated" from the landlord under the land reform proposal, this usual credit source may also phase out. So the credit problem is a critical one for the new "owners" who do not have title, and hence no collateral for bank loans.

The "food bowl" concept is quite different--basically an alternative to land reform. Large farms, of say 100 hectares, would be farmed by laborers, plantation style, but with no farmer having a designated area or crop of his own. This is about all the specifications that we have heard, but we have been urged by the central planning agency (NEDA) to explore this concept.

Farm Simulation Model.--One of the important influences to be considered is the variation in income due to changes in prices and yields of the various enterprises. This is a way of looking at uncertainty problems facing farmers due to variations in yields and in prices in a non-optimizing situation. A farm simulation model has been developed in the United States that seems applicable here as a complement to the equilibrium optimizing analysis. This approach based upon a given situation, calculates income and use of resources. It can be repeated for a number of periods under varying circumstances so that comparisons can be made between conditions of certainty and uncertainty.

The analysis is now in the testing stage for a farm producing one crop of rice and some upland crops during the dry season with two levels of technology. Comparisons will be made of the differences in income for each level of technology for both certainty and uncertainty conditions. From this, both gross and incremental benefit ratios can be compared with rates of return for each situation. If the test provides useful information, it will be used to tackle additional problems.

Analysis of Integrated Agricultural Survey.--The analysis here is being done along the same lines as that done in working paper no. 2 2/ except that all samples used in the January 1972 round in which detailed information was gathered on inputs will be utilized for the analysis. One complicating factor, however, was the significant occurrence of tungro in 1971-72. If those farms which had the disease can be isolated, then additional information might be gained about how much yield had decreased as a result of tungro.

Since there are 18,000 farm records in the sample, we are expecting that we can do analysis by principal regions of fertilizer-yield response. Also an idea can be obtained about the distribution of yields; these were shown in working paper no. 2 to be skewed, i.e., that arithmetic means are an inadequate measure of what farmers are actually obtaining. Thus, the mode or median may be more relevant measures for this purpose.

Demand-Price Agricultural Sector Analysis (Proposed).--An extension of a brief, informal treatment to an extended semi-formal analysis directed by special consultants. The semi-formal model will be a more explicit analysis of the agricultural sector and its interrelationship with the rest of the economy. A special computer program will combine the various price and output series available in the Philippines to calculate price indexes and value-aggregates of crops and livestock by principal categories and for the agricultural-food sector.

The proposed extension would include (1) an analysis and summary of available information and basic data for the Philippines agricultural sector in ways that facilitate systematic economic analysis, (2) development of analytical tools and procedures useful in appraising the demand for farm products and the related output response of farmers to economic and institutional incentives, and (3) preparation of projections and appraisals to illustrate how to use the information, analytical tools, and procedures to provide insights about the workings of the economy and some possible alternative economic prospects.

2/ Some Explorations on the Nature of the Green Revolution in the Philippines. Agricultural Diversification and Markets in the Philippines, Working Paper No. 2, January 1973.

Filipino participation throughout the development of the model and its application to agricultural planning will serve to institutionalize the series and the method of analysis consistent with the more integrated agricultural planning aims of the Philippine Government. This intersector regression approach is complementary to the activity analysis of the production-distribution linear programming model. The approach is an adaptation of one used in Vietnam by Ron Daly, Bob Hoffman, et. al., and members of this team would be logical nominees to direct the analysis in the Philippines.

Personnel and Activities

There was no change in ERS personnel assigned to ADAM, during the fiscal year with Atkinson and Kunkel on full-time assignments. Kunkel took up residence in the Philippines in December 1972. A short TDY visit was made by William Faught, and Richard Foote was TDY consultant from Saigon for 3 weeks on a demand-price analysis the principal agricultural products of the Philippines. For the year ahead, in addition to the proposed participation of Daly and Hoffman referred to above, arrangements are being completed for Fred Cooke to help with the delineation of homogenous agricultural areas and with Bill Bolton to assist in getting the programming model operational. Both will be drawing upon their recent experience with a similar model in Vietnam.

Among the Filipinos, there was little change in the 15 junior economists and clerical staff. For the intermediate level economists who had some graduate level training and experience, the 3 employed at the beginning of the year left the project during the year. Two replacements were secured, and one of these became administrative officer, replacing the officer who was promoted to a position in other work of the BAECON. The BAECON economist who had been working on the linear programming analysis of the optimum size farm is now working in the ADAM group.

Of the senior staff directors and advisers, Professor Pedro Sandoval took a position abroad and was replaced by Professor Aida Librero.

A planning conference held in Davao City, Mindanao in December 1972 was very helpful. Some of the best informed Filipino economists attended, gave us searching criticism and suggestions, and have been engaged as consultants for the project.

A broader conference is scheduled during the next year to be held with the North Carolina State directed portion of the research being conducted in Latin America. Six or 8 participants from the Philippines and an equal number of Latins will attend perhaps in Washington, D.C. In addition to presenting results, attention will be focused on other approaches to agricultural sector analysis and agricultural development with participation from other agencies.

AGRICULTURAL PRODUCTION RESPONSE,
INCOME AND EMPLOYMENT ANALYSIS SYSTEM