FINAL REPORT

Institutional Grant No. AID/csd 211(d) 3683

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PURDUE UNIVERSITY
Department of Agricultural Economics
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Institutional Grant No. AID/CSD 211(d) 3683

Title: Expansion of Competence in the Design and Execution of Ruminant Livestock Development Programs for the Tropics: With Emphasis on the Analysis of Systems of Production and Marketing.

Grantee: Purdue University, West Lafayette, Indiana

Director: T. Kelley White

A. Statistical Summary:

Period of Grant: June 29, 1972 to December 31, 1977

Amount of Grant: $400,000

Expenditures: For Current Year - $98,018
Accumulated - $390,097

B. Narrative Summary:

This report serves two purposes -- first, it will serve as the final report for the 211(d) Ruminant Livestock Development Grant to Purdue University for the period June 29, 1972 through December 31, 1977. Secondly, this report will serve as the annual report for the last year of the grant -- the last year actually being 18 months since the grant period was extended from June 28 through December 31. Following a brief summary statement of activities during the final period and a brief summarization of the overall impact of grant activities on Purdue University's competence in the ruminant livestock development area, a more detailed report of final period activities will be presented. Finally, a more detailed evaluation of the overall impact of the 211(d) grant on Purdue University's competence in the designated area will be presented.

The final 18 months of the 211(d) grant was for the Purdue University project team a period of accomplishment, anticipation and frustration. Significant accomplishments were achieved in the area of modeling of the livestock subsector in terms of both the Guyana situation and general modeling approaches. A second generation model was developed and applied to the Guyana situation by Mr. Tom Spreen as a basis for his Ph.D. dissertation. A third generation model, which will attempt to more realistically include the role of direct government involvement through investment and operations within the cattle industry in Guyana, as well as other than profit maximizing goals on the part of the Government of Guyana, was initiated under the 211(d) grant and will be completed with funding made available by Ford Foundation.

The final period began with a great deal of anticipation on the part of the Purdue 211(d) team, as well as the other participating institutions, that at least an initial step would be taken in establishing a meaningful linkage with the country of Mali as a second country of application for consortium activities. Through the efforts of Dr. W. H. M. Morris, agreement had been reached for consortium participation in a livestock modeling workshop to be held in Bamako, Mali, during the summer or early fall of 1977. It was hoped that this workshop would be the first step in a long-term relationship between at least some members of the consortium, the Government of Mali, and USAID in a thorough analysis of the Malian livestock subsector and development of appropriate programs and policies for more rapid development of that important sector. However, as time passed and one schedule change was followed by another and finally a very drastic change in both schedule and program content, the involvement of the 211(d)

Livestock Consortium in Mali within the timeframe of funding provided by USAID as a part of this 211(d) grant had to be abandoned.

The 211(d) Tropical Livestock grant to Purdue University and the association between Purdue University and the other three institutions involved in the Consortium (the University of Florida, Tuskegee Institute and Texas A & M University) was significant in spite of the many shortcomings and frustrations associated with the organizational mode and attempts to develop working relationships with other countries. The overall effect of the 211(d) grant on Purdue University Department of Agricultural Economics' capacity to contribute to a systems analysis of problems associated with development of programs for stimulation of the livestock sector of tropical less-developed countries can be categorized into the following:

1. Two systems models of the cattle subsector of Guyana were developed and computerized. The first of these models was presented to Guyanese officials and found by them to provide realistic results. Both these models have been documented and published for the benefit of scientists interested in the systems approach to livestock problems.
2. A third model of the Guyanese livestock sector which acknowledges the increasing role of direct government involvement in production and marketing and the emphasis of the Guyanese Government on goals other than profit maximization has been initiated by a Guyanese graduate student under the auspices of the 211(d) grant. While this work could not be completed during the timeframe of the grant, it is being completed with support from the Ford Foundation.

3. The 211(d) grant provided resources which made possible the involvement of eight members of the faculty of the Department of Agricultural Economics in tropical livestock production and marketing economics problems. This involvement not only significantly increased the capacity of the Purdue faculty to respond to future requests for assistance in less-developed countries, but has also had an important impact by increasing the acceptability of the systems approach to problem solving utilizing the multidisciplinary multiscientist team in both foreign and domestic programs.
4. Resources from the grant were used to develop an important collection of library materials relevant to tropical livestock and systems analysis methodology at Purdue University.
5. Grant resources were utilized for the training of three Ph.D. students in tropical livestock systems.
6. Grant resources were used to acquire two portable computer terminals with taping capacity and to demonstrate the feasibility of utilizing remote computer terminals in the less-developed countries as a means of linking those countries to the central computer facility at Purdue University. This is important in that it makes available computing capacity available on a large U.S. university campus to scientists, both domestic and foreign, working in countries without indigenous computer capacity.
7. Finally, even though efforts to establish a working relationship with Mali for a second country application by the Consortium were unsuccessful, two Malian graduate students have been enrolled in the Department of Agricultural Economics at Purdue University under

sponsorship by the USAID Mission in Mali. These students will work with Purdue faculty members in the application of systems analysis to the Malian livestock sector.

C. Detailed Report

1. General Background and Purpose of the Grant

The overall purpose of Purdue's 211(d) grant is well summarized in the following quote from the original grant document.

Purdue's grant is one of four that, "would explore the livestock industry from a total systems viewpoint, on the assumption that piecemeal attacks on a complex problem (nutrition, breeding, disease control, or credit) have been inadequate."

The primary objective of Purdue's grant is to strengthen our capability "to identify opportunities for significant livestock developments in LDC's, to analyze constraints to, and reasons for, such developments and to design programs to overcome constraints through an integrated, multidisciplinary team approach."

Purdue was awarded a supplemental grant in the amount of $150,000 for the three year period beginning July 1, 1974. This supplemental funding was provided to allow Purdue, in its role as the economic and marketing component of the Consortium, to better support the biological production expertise provided by Texas A & M, Tuskegee Institute and the University of Florida. Four specific areas requiring expanded Purdue input were recognized. These are:

1. Expansion of the scope of the industry modeling activity to give greater emphasis to factor and product markets faced by livestock procedures;
2. To participate in a consortium effort to apply the systems approach to livestock development problems in a second country;
3. To exercise the integrator-catalyst role that is implicit in the industry modeling activity; and,
4. To provide additional economics and systems modeling support to other consortium members.

II. Objectives of the Grant

1. Objectives Restated:

The objective of the grant was to improve the capacity of Purdue University to assist AID, other developmental agencies, and countries in the analysis of ruminant livestock production and marketing systems in the different environments of the LDC's. Such analysis should describe the system, indicate the factors that most seriously limit development, and suggest alternative policies and programs to remove limiting factors.

Steps to be taken to achieve these objectives include:

a. adapt systems approach to a specific tropical ruminant livestock production situation,

b. improve our analytical methodology,

c. increase the number of faculty with relevant experience (in systems analysis and tropical ruminant livestock production,

d. to select a country, and

e. analyze its livestock industry so as to achieve (a) through (c) above.

2. Review of Objectives

The five-and-one-half year effort by members of the 211(d) Consortium to attain the original set of objectives of the four grants has tended to support the relevance of the original set of objectives. It is pertinent to point out that the fourth year formal review of the four grants by a USAID review team also reinforced the relevance of the original objectives and the need for a multi-institutional, multidisciplinary approach to the application of systems analysis to tropical livestock problems in the less-developed countries. However, it became obvious very early in the grant period that each of the four institutions had rather different perceptions of the purpose of their grant and the role that each should play in attaining the joint objectives. Given the fact that four independent grants were

made to the institutions and they were instructed to form themselves into an informal consortium with a rotating chairmanship, provided an organizational structure which was inadequate to fully achieve the overall objectives of the set of 211(d) grants.

III. Accomplishments

The accomplishments of Purdue University under the 211(d) grant will be discussed under the headings of steps (a) through (b) presented in Section II.1 above. The overall accomplishments of Purdue University under each of these headings during the entire five-and-one-half year grant period will be presented briefly with more detailed discussion of accomplishments during the final 18 months of the grant period.

c. Adapt systems approach to a specific tropical ruminant livestock production situation

The consortium jointly decided early in its life to learn to apply the systems approach to LDC livestock economies by selecting a specific country, Guyana, South America, and developing and applying a systems model to the livestock economy of that country. It was determined that Purdue University should have primary responsibility in the area of economic analysis and provide leadership in developing aggregate economic-biological models to be utilized in applying the systems framework. Purdue University participated fully in joint consortium efforts to obtain data describing technical and economic constraints facing the Guyanese livestock industry. It is fair to say that the consortium functioned best as an integrated unit in efforts to obtain data which would adequately describe the Guyanese livestock industry. Tuskegee Institute assumed primary leadership for a producer survey while Texas A & M provided leadership in a field study of animal health problems and also cooperated closely with Purdue University in acquiring technical

production data for typical producing units. Purdue University, in collaboration with Guyanese scientists, conducted a study of consumption habits with respect to livestock products and interacted intensively with government and market organization officials to identify policy objectives of the Guyanese Government and to describe the market structure that exist. A description of the Guyanese livestock sector, based on these data, was presented in the second annual report by Purdue University.

Purdue University efforts to apply systems analysis techniques to the Guyanese livestock industry resulted in the development of two computerized sector models of Guyanese livestock production and marketing. The first of these was developed as a Ph.D. thesis by Mr. Ralph May entitled: "A Systems Model of the Cattle Economy--A Guyana Application". Mr. May's model was presented at a workshop in Georgetown, Guyana, and was judged by Guyanese Government and industry personnel to provide realistic results for the economy. This model, however, had a number of recognized deficiencies. First, it was able to consider only a limited time span of approximately five years due to practical capacity limitations of the computer given the size of the model. Secondly, the model was less dynamic than is desirable because of the limited time horizon it could be observed, because it assumed a once-and-for-all decision making process rather than an iterative decision process, and finally, because it was necessary to utilize assumed, static inventory prices for the herd remaining at the end of the planning horizon.

A second model, building upon what had been learned in Mr. May's thesis, was developed by Mr. Tom Spreen as his Ph.D. thesis. Mr. Spreen's thesis, which corrected those deficiencies identified above in the first model, was entitled: "An Application of Capital Theory in a Recursive Linear Programming Model of the Cattle Subsector of Guyana". A modified version of the model developed by Mr. May has been published in the Journal of

Agricultural Systems, No. 3, 1978, under the title, "A Systems Analysis of the Guyanese Livestock Industry", by T. Kelley White, B. A. McCarl, R. D. May and T. H. Spreen. A complete set of documentation for the original systems model for Guyana, including input forms and a users guide, were developed and made available to USAID and the Government of Guyana. A users guide for the second generation model developed by Mr. Spreen has been published as Purdue Agricultural Station Bulletin No. 170 entitled, "Users Guide to the Purdue Cattle Industry Model Computer Program". Two additional manuscripts describing various technical aspects of Purdue efforts to develop realistic systems models of national livestock economies have been developed and are in review by U.S. agricultural economics journals. Mr. Spreen's thesis and the publications listed above were all completed during the final 18 months of the grant.

While the Consortium was attempting to develop systems models of the Guyanese livestock industry, significant changes in the structure of the livestock economy were occurring in Guyana. The Government of Guyana chose to have a much greater degree of direct government involvement in both production and marketing of livestock and livestock products and to depend to a much lesser degree on market forces to control production and distribution. In addition, the Government decided to reorder priorities in such a way as to place greater emphasis on dairy production and relatively less on the production of beef. In recognition of these structural changes and the effect that such changes had on the adequacy of our first two models to describe and evaluate livestock sector performance, it was decided to develop a third model which would incorporate the structural changes and change in focus from beef to dairy. Work on this third generation model was initiated by Mr. John Deep Ford, a Guyanese Ph.D. student at Purdue University. Mr. Ford traveled to Guyana in December 1976 and January 1977

to discuss such a model with Guyanese officials. He returned to campus and developed the conceptual outline for such a model. In the summer of 1977, Mr. Ford returned to Guyana for one year to work with the Guyana Livestock Corporation, the government entity responsible for livestock production and marketing, and to collect data necessary for specification of his model. Since a request for carry-forward of grant funds to support completion of Mr. Ford's work was denied, arrangements have been made for Ford Foundation to support Mr. Ford in the completion of his dissertation. It is anticipated that this work will be completed by the end of calendar 1978.

b. Improved Analytical Methodology

The principal contribution that Purdue University has made under the 211(d) Tropical Livestock grant has been in the development of analytical methodology appropriate for modeling of aggregate livestock economy activity. These methodological innovations have been encompassed in the two livestock models completed as thesis and in the model under development currently by Mr. Ford. These models have been acknowledged by the profession as new developments in modeling and analytical methodology as evidenced by their acceptance for publication in recognized professional journals. These models are a significant contribution in that they provide for linking within a single computerized model the economic structure of producers and marketing institutions which constitute supply and demand forces in an economy together with the biological and physical constraints placed on production by herd dynamics and resource availabilities. Thus, it is possible within these models to simulate behavior of producers and consumers under alternative sets of technical, market and policy situations. This is of great value to policy-makers, scientists and planners in less-developed countries in that they can

simulate the effect of anticipated policies, market interventions and technological developments with a computer model rather than having to experiment with the economy itself.

With the completion of Mr. Ford's model, we will have the capacity to apply computerized models to either situations in which market forces are allowed to guide the decision-making process of producers, marketing firms and consumers or the situation in which government takes a much more direct role in deciding on levels and composition of production and the price at which products and inputs are exchanged. This variety of analytical tools will be of long-run benefit to the less-developed countries in which livestock is an important component of the economy and to USAID in its efforts to provide program resources to stimulate livestock production and increase the contribution of the livestock sector to overall economic well-being of the poorest of the poor.

While all models developed under the 211(d) grant have been made specific to conditions existing in Guyana, general model structure has been made general so that the modeling technique can be applied to a wide variety of conditions existing in the less-developed countries. In addition to development of models, a complete package of software has been developed including input forms which facilitate the acquisition of data necessary to specify the model for a particular country. Thus, it is anticipated that these analytical tools will be of broad applicability and value in the future efforts by USAID and the less-developed countries themselves to analyze problems associated with livestock development in the various less-developed countries.

c. Faculty With Relevant Experience

From the very beginning, Purdue University adopted the strategy of involving in its 211(d) project a combination of senior faculty, junior faculty and graduate students. This strategy had the advantage of providing a core of experienced researchers to oversee research activities aimed at applying systems analysis to livestock industry problems and planning. At the same time it afford an opportunity for junior faculty members to become involved in livestock economics analysis with an international application. This had the advantage of training young scientists who would be able to continue in the long term such international activity and also integrate the experience in the international arena into their domestic research, teaching and extension programs. The advantage of involving graduate students in the project was to train a small cadre of professional agricultural research economists in the techniques of analysis necessary for adaptation of systems analysis to problems of the livestock economy.

Grant resources were utilized to provide opportunities for faculty and graduate students to travel and work in the less-developed country environment as a part of the 211(d) research program. This travel was concentrated in the Caribbean region because of our initial focus on Guyana. However, travel and experience was not limited to Guyana as faculty and graduate students traveled and worked in Jamaica, Trinidad, Barbados, Belize and Mexico in the Caribbean region. In addition, two members of the Purdue team, Drs. White and Morris, were provided opportunities to travel and study livestock production and marketing in a number of West African countries including Mali, Upper Volta, Chad and the Cameroons. With the support of the 211(d) grant, Purdue University has been able to develop a cadre of agricultural

economists with experience in and knowledge of the economic problems of livestock production and marketing in a variety of less developed countries. At the same time, this cadre of economists has had experience of developing analytical techniques and applying them to the Guyanese livestock industry. This pool of expertise has been drawn upon by USAID in a number of instances and we anticipate that the resource will continue to be utilized in the future.

Unfortunately, several members of the 211(d) team at Purdue University have been confronted with opportunities in other institutions and have chosen to leave Purdue University. Dr. Will Candler, who was the initial project director, is currently with the World Bank. Dr. Arlo Minden, who was a member of the initial team, subsequently left Purdue University to spend one year with USAID in Washington and, subsequently, moved into private industry. The graduate students trained under the 211(d) grant are currently on the faculty at the University of Arkansas and the University of Florida. Mr. Deep Ford, who will receive his Ph.D. degree in the fall of 1978, will return to Guyana where he will be employed by the Guyanese Livestock Corporation and, therefore, will have a continuing opportunity to utilize his knowledge and experience in guiding the future development of livestock in his home country. Therefore, while several members of the Purdue team are no longer at Purdue University, their knowledge and expertise gained under support of the 211(d) grant is still available and will be multiplied by their influence on the institutions in which they currently are employed. Without the support of the 211(d) grant, the body of experienced professionals in systems analysis of livestock industries in less-developed countries would not exist. It is imperative, if the investment

made by USAID through this 211(d) grant is to have the ultimate payoff, that the Agency find a better mechanism for utilization. To date attempts by the Consortium, Purdue University and USAID to find a formal mechanism for making the expertise of the Consortium available has shown a striking lack of success. However, the potential continues to exist but will dissipate over time if not utilized.

d. Choice of Location for Work

Early in the life of the 211(d) Consortium, it was decided that after completion of work in developing models and conducting analysis of selected problems in the Guyanese livestock industry a second country should be selected and arrangements developed for an attempt to adapt the systems models developed in phase one to conditions existing in the second country. This effort turned out to be extremely frustrating and almost fruitless. Early contacts were made by the Consortium with AID Mission personnel in Kenya and Tanzania. Both of these efforts proved to be fruitless. Following this, an effort was made by Dr. W. H. M. Morris of the Purdue 211(d) team to work out arrangements for Consortium involvement in Mali. There was a strong interest on the part of individuals within the Malian Government for such an involvement. Recognizing that the time already lost left insufficient time for a full-blown systems analysis of the Malian livestock sector, tentative arrangements were made for the conduct of a systems analysis workshop in Bamako, Mali, in the summer of 1977. Members of the Consortium developed a program for such a workshop which was presented to an official of the Malian Government who was in the United States on a short-term training program. In consultation with the representative of the Malian Government, modifications in the workshop program were made and preparation

for the workshop proceeded. The Malian Government then decided to postpone the date of the workshop until the fall of 1977 to coincide with the anniversary of their livestock experiment station. In order to comply with the desired date expressed by the Malian Government, USAID gave the four universities involved in the Consortium an extension of their grant period through December of 1977. Then during the fall of 1977, in consultation between USAID representatives in Paris and the Malian Government, a decision was made to further postpone the workshop until early in 1978 and to drastically change the format of the workshop. Rather than focusing on the application of systems analysis to livestock industry problems, the workshop was expanded to a two week workshop on agricultural systems in general. At this point, it became infeasible for AID to extend the 211(d) grants further and the universities involved did not have internal resources to allow for full participation. Purdue University did participate in the farming systems workshop to the extent of providing time and travel for Dr. W. H. M. Morris to participate during a part of the conference. This was funded through other AID research contracts.

We at Purdue University regret very much that arrangements could not be worked out for an application of systems techniques to the Malian situation. However, as a result of our efforts to make such arrangements, two Malians were identified to enroll in graduate study in agricultural economics at Purdue University. These two individuals have been funded by USAID/Bamako for their work and have focused their studies on livestock economics and the application of systems analysis. One of these individuals, Mr. Tiena Coulibaly, is completing a non-thesis Master of Science program during the summer of 1978 and will be returning to Mali to work within the Malian Ministry of

Agriculture in the Livestock Division. While he has not conducted research for a thesis, he did conduct a special problems course in which he did a preliminary analysis of the economic feasibility of stratification of Sahelian beef production.

The second Malian graduate student, Mr. Niang, who is in charge of statistical analysis for the livestock section of the Ministry, is continuing his studies at Purdue University and has initiated thesis research which will involve an adaptation of our systems model to Malian conditions. It is anticipated that Mr. Niang will continue for Ph.D. training and will continue to focus his research on the application of systems analysis to the Malian livestock sector. Therefore, while the Consortium was unable to arrange a second country of involvement, we at Purdue University have been able to evolve a limited working relationship with the Malian Government which will, over time, result in the application of our systems modeling techniques to the livestock sector of that country.

IV. General Concluding Comments

The 211(d) Tropical Livestock grant to Purdue University has been an important resource which has provided a mechanism whereby the Department of Agricultural Economics of Purdue University has been able to develop a cadre of trained economists familiar with livestock production and marketing problems in a number of less-developed countries of the world. It has also provided for the development of important new analytical models which will have long-run applicability by less-developed countries and by donor agencies in the evaluation of potential programs, policies and technical interventions. While many problems were encountered and the organizational structure of the Consortium found to be inadequate to provide incentives and

direction for accomplishment of full interdisciplinary integration of all members of the Consortium, a tremendous amount of progress was made in developing an interdisciplinary cooperative approach to analysis of problems associated with livestock production in tropical LDC's.