SELECTED U.S. AGRICULTURAL PROFESSORS' INVOLVEMENT WITH AND PERCEPTIONS OF AGRICULTURAL TECHNOLOGY IN DEVELOPING COUNTRIES

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Chapter I

Introduction

When the issue of world hunger is viewed from developing countries perspectives, the most striking and serious aspect of the situation appears to be the tragic and monumental famines in Northeastern Africa and the Sahel zone of West Africa. Neglect, government policy and sectorial biases are frequently cited as reasons for low agricultural production in several developing countries. Development efforts through credit facilities, extension services and rural infrastructure are strategies to correct and compensate for the sectorial biases. "Africa is experiencing the fastest population growth rate, averaging three percent and exceeding four percent in some countries" (Okigbo, 1985a).

> Decline in food and agricultural production has been attributed to alarming population increase relative to food production. Africa's food supply compares favorably with that of the world as a whole, but the fast population growth has resulted in a situation in which Africans have had increasingly less food per person since the 1970s as compared to the previous years (Brown, et. al., 1984).

Factors such as illiteracy, lack of family planning education and religious barriers to the use of birth control

are perceived as contributing to an unmanageable population explosion.

Cunningham (1990) concluded in his study that respondents perceived that there were more significant problems with population control in the rural areas than the urban areas in Latin American countries. He further concluded that the majority of rural people in Latin American countries are self-employed in subsistence agriculture and are in desperate need of agricultural and technical training to achieve basic functional literacy that will assist to increase their productive capacities. The choice to migrate from rural to urban and very large cities may be the result of failure to live and sustain life under limited resources of rural areas. This problem is typical of many depressed areas in the world and the people involved in this process are usually youths and high school/college leavers and drop-outs. The situation in many Latin American towns as noted by Cunningham (1990), results in unsanitary environments, poor health, crime, overcrowding and immorality in the urban centers.

Malasis (1975) determined that developing nations typically have: (1) extremely high percentages of their populations engaged in agriculture; (2) maintain a high percentage of agricultural exports in relation to total exports; and (3) agricultural sectors which contribute heavily to total gross domestic product. In the Middle East, agriculture continued to support a high proportion of the labor force

but on the whole, total employed population in agriculture has fallen. Also in many Middle East countries, agriculture's contribution to GDP has persistently dropped. This is true for many developing countries. In effect, world hunger and food crises continue to pose an insurmountable problem to mankind; 40,000 children around the world die everyday from preventable diseases (Saffer, 1989), and another 35,000 children die each day from malnutrition (Christian Children's Fund, 1989). The hardest hit are children from developing countries and non-self-sufficient nations.

Statement of the Problem

The agricultural developments in many countries of the industrialized world were the result of technological revolution initiated after World War II. The essence of technology is to eliminate operations done by hand or operations done by older machines by increasing productivity and efficiency of machines for practical operations. "Webster's Dictionary," defines technology as the totality of the means employed to provide objects necessary for human sustenance and comfort. In many developing countries, technological changes in agriculture involved moving from the use of hand hoes, knives and cutlasses to use of animal draft power and adoption of improved varieties of seeds. The central problem of this study lies on the slow pace of agricultural productivity and growth in many developing countries which can be attributed to

the level of agricultural technology in these countries. Perceptions of selected U.S. agricultural professors are being elicited in this study with the hope that their views will contribute a great deal in solving this problem by providing appropriate direction for developing countries agriculture.

Purpose of the Study

The purpose of the study was to determine the extent of involvement in developing countries by selected U.S. agricultural professors and their perceptions of the current and projected needs regarding agricultural technology.

Objectives of the Study

To accomplish the purpose of this study the following specific objectives were developed:

(1) To determine respondents' extent of involvement and sustained interest in agricultural technology development in developing countries.

(2) To determine respondents' perceptions with regard to the impact of selected agricultural technology on level of crop and livestock production in many developing countries.

(3) To determine respondents' perceptions as regards the level of importance of selected agricultural technology with respect to achievement of sustainable agriculture in developing countries.

Scope of the Study

This study included 83 selected agricultural professors from Mid-America International Agricultural Consortium (MIAC) universities. MIAC like Title XII universities are institutions that are very active in international agricultural development. The study included agricultural professors with recent experience in agricultural development in developing countries within the past five years.

Assumptions of the Study

For the purpose of the study the following assumptions were made:

1. The subjects are very knowledgeable about agricultural development in developing countries to the extent that they can provide accurate answers.
2. Developing countries referred to in this study have approximately the same level of agricultural development.
3. The questionnaire developed would elicit all the information needed to satisfy the objectives.
4. It was further assumed that respondents will respond to the questions in a manner not biased by their areas of specialization.

Definition of Terms

The following terms have been defined in order to enhance a better understanding of facts and materials presented in this study:

MID-AMERICA INTERNATIONAL AGRICULTURAL CONSORTIUM (MIAC): An association of five Southwest and Midwest Universities. These institutions include: University of Missouri, Columbia, Missouri; University of Nebraska, Lincoln, Nebraska; Kansas State University, Manhattan, Kansas; Iowa State University, Ames, Iowa; and Oklahoma State University, Stillwater, Oklahoma. These institutions are all known to be very active in international agricultural development.

DEVELOPING COUNTRIES: These countries are so classified by World Bank on the basis of per capita Gross National Product (GNP). Developing countries are further classified into high income, middle income and low income countries. A great majority of these countries are located in the southern hemisphere and belong to one of the following continents: Africa, South and Central America (Latin America), and Asia.

AGRICULTURAL TECHNOLOGY: As it pertains to this study refers to the vast array of devices, inputs designed to eliminate or facilitate operations done by hand to increase productivity and efficiency.

SUSTAINABLE AGRICULTURE: A continuing practice or method of production that persists for a long period of time.

Chapter II

Review of Literature

This chapter is a review of literature related to this study. For the purpose of clarity, this chapter is divided into five major sections. Each section title deals directly or indirectly with the title of the study. The five major areas of literature review in the study include: (1) Historical backgrounds of traditional and existing agricultural production systems in developing countries. (2) Technology and agricultural development in developing countries. (3) Technical assistance and technology transfer to developing countries. (4) Agricultural policies in developing countries. (5) Some related studies.

Agricultural professors used in this study were selected from the five institutions making up Mid-America International Agricultural Consortium (MIAC). These institutions include: Iowa State University, University of Nebraska, Kansas State University, Oklahoma State University and the University of Missouri. MIAC is a not-for-profit corporation registered in the state of Missouri to assist in alleviating world hunger. Development cooperation and international agriculture programs are part of the mission of each institution. The governing

board and top administrative officials of each university encourage and support international development work. Sustainability is a high priority of MIAC programs.

Historical Backgrounds of Traditional and Existing Agricultural Production Systems in Developing Countries

There is little strong evidence on the origin of agriculture in Africa. However, sources including Okigbo (1984), Murdock (1959) and Porteres (1962), provide scanty archaeological, botanical, historical and linguistic ideas and clues. It is generally accepted now that after several hundred years of trial and error with experimenting on plants and animals, two agricultural complexes evolved. Porteres (1962), identified two agricultural complexes; a seed agricultural complex and a vegicultural one indigenous to Africa. Porteres further identified the geographical zones where each complex thrives. The seed agricultural complex characteristic of the Savannah involves growing of cereals such as sorghum (sorghum bicolor), millet (pennisetum and digitaria spp) and grain legumes such as Bamabara groundnuts (Vound Zeia Subterranea) in open fields. Harlan et. al. (1976) determined that traditional African agriculture consists of a mosaic of crops, traditions and techniques and does not reveal a center, nuclear area or single point of origin. These basic types of agricultural systems have persisted over the years with only

some slight introductions of seed and vegetables in middle belts between Savannah and forests. Middle belts can support the growing of cereals as well as tubers in many areas in Nigeria. "Rice culture development dates back to five thousand years ago" (Harris, 1976 and Gallais and Sidikou, 1978).

Varieties of oryza glaberrima (red rice) which mature at various times in shallow or deep water and various short-duration crops were selected to fit different flood water regimes. "These indigenous agricultural systems provided effective support for several ancient empires and kingdoms in West Africa consisting of Ghana, Mali, Mossi, Benin, Arante and Oyo" (Jarret, 1980, and Crowder, 1972).

African agriculture over the years was influenced by ideas, techniques and materials from elsewhere. Following the discovery of America in 1492, new world crops such as maize, cassava, groundnuts, papaya, and cocoa were introduced. Okigbo and Greenland (1976) stated:

> . . . significant changes in African agriculture resulted from the following: (1) recent population explosions in tropical Africa; (2) European colonization with emphasis on cash crops ushered an era of increased commercialization of agriculture; (3) high priority given to export crops by colonial powers; (4) urbanization; (5) expansion of cassava production due to its adaptation; (6) increasing mechanization of agriculture; (7) irrigation; and (8) introduction of plastics into agriculture.

Existing Agricultural Systems in Tropical Africa

From a historical standpoint traditional agricultural systems evolved through trial and error. The farmer's efforts contributed to the development of transitional agricultural systems. Science, scientific research and technology are applied in the development of modern agricultural systems. Dassman (1974) and Klee (1980) referred to modern agriculturists as "biosphere people" and traditional farmers as "ecosystem people." They were referring to the management of resources in modern agriculture which is obtained not locally but from worldwide sources. Traditional and transitional agricultural systems involve increasing intensities of cultivation and land use, including: (1) shifting cultivation and nomadic herding which are the most extensive; (2) bush, woodland, thicket and grassland fallows; (3) recurrent cultivation; (4) specialized agriculture: [a] terraced agriculture, [b] floodland or valley-bottom agriculture. Ruthenberg (1974) has reported marked variations in the lengths of cultivation and fallow periods. The reasons for variations in lengths of fallows have not been thoroughly investigated. In true shifting cultivation, it is a tradition for the farmer to relocate the homestead. Allan (1965) and

Ofori (1974) have reviewed the reasons for relocation of homestead and the situation varies from where the farmer may never return to the same piece of land previously cultivated to situations where cultivation is repeated on the same plot. Morgan (1969) reported that shifting cultivation has disappeared in West Africa and only restricted to parts of Ivory Coast and small areas between Nigeria and Cameroon, parts of Zaire, Rhodesia (Zimbabwe) and Zambia. This can be attributed to the introduction of modern farming systems such as mixed farming (Allan, 1965). Shifting cultivation is a part of a continuum of intensification of crop production and integration with livestock rearing. Nomadic herding which is the extensive animal rearing is the counterpart of shifting cultivation and is at one end of the continuum.

Agricultural Policies in Developing Countries

Input Policy: Input policy refers to the ways various governments try to influence the purchase of quantities or combinations of purchases of inputs such as fertilizer, herbicides, pesticides, animal feeds, weedicides and seeds of high yielding varieties. Governments may want to influence different aspects of the input system such as price level paid by farmer, delivery systems to farmers and information available to farmers concerning the input type.

Serious input policy problems and debates erupt such as

input subsidy problems, state delivery problems, problems of delivery failure or diversion, most serious of which are illegal marketing of input at unofficial prices, smuggling of the input across the border, etc. The World Bank (1986) has expressed an anti-subsidy view by many agricultural experts due to the resources mis-allocation and financial problems of subsidies. (Tarrant, 1982 and Timmer, 1986) "Still others continue to think that subsidies have an important temporary role in encouraging farmers to raise input use levels." This is in favor of the fact that many governments such as Nigeria have not abandoned or canceled subsidy programs to farmers.

Credit Policy: (Shaw, 1973; McKinnon, 1973; Donald, 1976; Fry, 1982) "Since the mid-1970s a considerable volume of critical literature has appeared concerning credit policies in developing countries." The most serious problem of credit is fungibility as noted by many writers (Von Pischke and Adams, 1980). The fungibility attribute of credit, and of loanable funds more generally, invalidates most state targets and regulations for credit delivery. As pointed out by Von Pischke and Adams fungibility exists at all tiers of the credit systems, from the farmer, to the financial intermediary, and to the central bank. Fungibility simply means the substitution or diversion of funds, for instance loans targeted for specific purposes such as fertilizer use may be used by the household for the purchase of a sewing machine.

Mechanization Policy: Farm mechanization in developing countries involve the substitution of labor power or animal power by machine power using four-wheel tractors in such operations like ploughing, harrowing, sowing, weeding and spraying crops. Although it is generally accepted that tractors increase crop yields per hectare, but according to Binswanger (1978) a study carried out at the end of the 1970s on the impact of tractors in South Asia found little evidence in support of the above proposition. Mechanization tends to be associated with labor saving, fixed capital and substitution. Substitution is viewed from a standpoint that machines substitute for labor with no increase in net output. Studies by Agarwal, 1981; Gill, 1983; and Lingard and Sri Bagyo, 1983, are in support of the substitution view of tractors. McInerney and Donaldson (1975) in a sample survey undertaken to examine the impact of tractorization in Pakistan in the early 1970s found that average farm size before and after acquisition of tractors increased from 18 to 44 hectares. Most of the studies on tractors are not in support of the notion that the output gains of tractors are sufficient to outweigh their disadvantages. Nevertheless, Lingard and Sri Bagyo (1983) concluded that tractors can dramatically accelerate increases in farm size. The central issue on mechanization policy is on policy failures and effects. As Abercrombie (1972) pointed out that past government policies in Latin America concerning agricultural mechanization have thus been

somewhat haphazard and inconsistent. According to Rudra (1987), the government of India has let manufacturers produce and sell whatever farm machinery they wanted to and let farmers introduce whatever mechanization that caught their fancy.

Mechanization Sequences and Diversity: Tractors are usually viewed as typical symbols of modern farming, but mechanization involves a wide range of farm machinery and for this reason, state governments and farmers in developing countries must select those items that lead to a rise in net income. Binswanger (1984) emphasizes the potential diversity of mechanical devices, the need to identify specific operations rather than take a whole farm approach to mechanization.

Binswanger (1984) makes a distinction between power-intensive farm operations and control-intensive operations. The former relies predominantly on additional energy, while the latter depends on human control as well as more energy. According to Binswanger, operations least sensitive to relative wage levels such as milling, threshing, chopping, crushing sugarcane or pumping water are the first to be mechanized. In that sequence, the next category of operation to be mechanized is mobile power-intensive operation, the main one of which is ploughing. The final category of operations to be mechanized are those that require skill as well as energy and these include fertilizer application, weeding, sowing (transplanting) and harvesting.

Technology and Agricultural Development

Sources of Technology in Development: Of primary importance for developing countries is the development of competence in the field of technology choice and an institutionalized technology choice. A sound technology policy and innovation can contribute to economic growth and productivity. As Jones (1971) observed, innovation can allow for a more efficient use of resources; greater productivity can be achieved with existing resources and resources that were previously unobtainable or considered of low value can be made available. Technical choice is a determinant of the nature of economic growth and achievement of various developmental goals. The actual choice of technology as Singer (1977) explained, is made by various persons who are decision makers, transitional enterprises which strive to maximize world-wide profit, national governments whose goals vary but may include modernization, redistribution of wealth, or increased employment, and the family firms and small firms, whose principal concern is to maximize family consumption. A significant proportion of modern agricultural technology and manufacturing has been developed in the industrially advanced nations such as France, Germany, Russia, the U.S. and Great Britain. Singer (1977) pointed out that "off the shelf" technology for less-developed countries is seen as a means of avoiding the considerable expense of the structures necessary for creating such technology. There is really little advantage on the part

of third world countries considering the acquisition expense. Stewart (1977), has estimated that by 1980 as much as one-third of world export receipts will be spent on capital repayment for foreign technology.

Education of producers in the proper use of improved varieties of crops and appropriate technology can be a major constraint to increasing productivity. Shukla (1971) concluded that effective educational programs can do much to shorten the lag time between the discovery of a new practice and its adoption by all farmers. Adoption of an agricultural innovation can be influenced by factors such as cost to the farmer, potential for increasing returns and according to Ruthenberg (1985) a demand must exist and there must be a marketing system in which the farmers are confident.

Considering the phenomenal success of United States Agriculture, it may be important to point to the strengths and weaknesses of appropriate technology toward the success of the food and fiber system of U.S. and assess whether the same technological package can be appropriate for less developed countries. The concept of appropriate technology has been defined in many ways and approaches by different writers. Jedlicka (1977) broadly defined appropriate technology as "one that effectively utilizes the manpower, resources, and environmental and institutional realities . . . in a given country."

Schumacher (1971) elaborated some criteria for appropriate technology which are still applicable.

1. Jobs have to be created in areas where people are living now - not primarily in metropolitan areas into which they tend to migrate.
2. They must be cheap enough so they can be created in large numbers without requiring an unattainable level of savings and inputs.
3. The production methods employed must be relatively simple so demands for high skills are minimized - not only in the production process itself but also in matters of organization, raw material supply, financing, marketing, etc.
4. Production should be largely from local materials. A very strong argument for the success of U.S. agricultural technology, was that U.S. agricultural technology development followed some kind of time and need sequence; at a time that labor was identified as a factor scarcity, labor saving machines were developed, land-saving technology in form of hybrid seeds and fertilizers were developed to produce more to meet the demand due to war. On the other hand the LDCs tend to use technology to substitute for labor even when ample labor supplies exist.

Technical Assistance and Technology Transfer to Developing Countries

Technical assistance became necessary as farming intensity requiring irrigation, drainage, leveling or terracing increased in many developing countries. "Presently a major technological solution for increasing food production and alleviating poverty, particularly in the Asia region, is irrigation development" (Coward, 1980). A large proportion of investment funds in agriculture in many developing countries are allocated on irrigation projects. Issues of irrigation development in Asia focuses on high use of modern inputs, reliability, predictability and flexibility of water use.

Of greater concern is finding a technology which fits for a particular society. Axinn (1978) defined technology as a body of knowledge applied to specific ends. In his definition specific ends referred to fit. That is to say in a given society technology is developed to fit or solve specific problems. Axinn argues further that appropriateness of technology stems from the fact that some agricultural technologies may be suitable for large-scale farming; while others may be suitable for small-scale farming. some may be capital-intensive while others are not. The basic concern being an attempt to transfer technology that fits a culture. One good example of transferring a technology that does not fit as cited by Axinn is the case of transferring insecticides to a culture that uses those insects for meat. The common practice

in such cultures would be to employ family labor to pick the insects.

Means of Technology Transfer

As noted by Buttel (1981) a major vehicle for technology transfer to developing countries is the international agricultural research centers, funded through the consultative group on International Agricultural Research (CGIAR). According to Flinn and Buttel, the international agricultural research centers have spearheaded major technological changes in developing countries' agriculture that have occurred in the past three decades.

Another means of technology transfer cited by Shaner (1982) is project. Projects as observed by Shaner serve the dual purpose of increasing income and welfare through production of goods and services and of providing an opportunity for transferring technology to the project area. An example is the USAID funding of an irrigation project for small-scale farmers in Peru which concomitantly expanded the area's irrigation network and introduced improved irrigation techniques by funding technical assistance in agricultural research and extension.

Other Kinds of Transfers and Links

Besides international technology transfer to developing countries, large-scale agricultural research and extension

work in many developing countries has been responsible for the transfer of agricultural technology to local farmers within these countries. Case studies on national agricultural research for nine countries including Bangladesh, Ecuador, Guatemala, Indonesia, Nepal, Panama, Senegal, Zambia and Zimbabwe by the international service for National Agricultural research (ISNAR) focus on the analysis of these case studies stressing the role of on-farm research as a means of strengthening links between research and extension.

Extension is considered by agriculturists as sequentially and closely linked with research, receiving its inputs from research and organizing them into a package of services to the farmer. Martinez, 1989, observed that the reciprocal interdependence between extension and research was recognized with extension identifying problems and supplying information which enables researchers to define priorities.

In many developing countries, local research institutes provide knowledge and technique to solve farming problems that are location-specific. Mijindadi (1984), wrote on the regional agricultural research station at Samani, Northern Nigeria which is now a branch of Ahmadu Bello University. As noted by Mijindadi, current fertilizer recommendations on major crops in Northern parts of the country was based on agronomic research carried out by various workers in the late 1950s and early 1960s.

Okigbo (1985b), reported the activities of the

International Institute of Tropical Agriculture (IITA) on three major program areas including crop improvement, farming system program and international cooperation and training program. As noted by Okigbo, the principal objective of the Farming System Program (FSP) is the development of new technologies, alternative systems, and more permanent production systems for higher sustained yields of improved major and some minor food crops.

Cited Technology Transfer Constraints

Agricultural technology transfer and adoption in low income countries face a number of constraints. Brady (1983), outlined three major constraints to agricultural technology transfer to developing countries including: (1) physical and biological constraints such as breeding new varieties of crop and livestock that can flourish under adverse climatic conditions; (2) social, economic and political constraints, e.g. land reform issues, food prices, and (3) constraints of trained manpower.

Falusi (1985) identified several reasons that limit fertilizer use in sub-saharan Africa as the following:

1. The favorable land/man ratio and the practice of shifting cultivation.
2. Inadequate funding of research.
3. The limited knowledge of the soil-fertility conditions.
4. Limited irrigation.

5. Poor dissemination of demonstration results, and
6. Limited credit.

Related Studies

This section of the literature review presents an overview of several studies done in the past that are related to this very study.

In a case study of a Tunisian rural community, Ben-Achour, Arbi (1988) analyzed the basis of rejection of agricultural innovations by small farm operators. The overall conclusion drawn is that in Tunisia, the social/political structure is biased against the poor rural farmers, and their interest are not being served by the government and other institutions and by most of the developers and technicians who adopt an elitist attitude and often treat the farmers with contempt.

Mekonnen, Hailu (1991) conducted a study of the structure of agricultural production, factor productivity and technology adoption in COTE d'IVOIRE. The structure of COTE d'IVOIRE agriculture was assessed using household survey data collected for the 1984-85 crop year. A Cobb-Douglas production function, taking into account conventional inputs (land, labor, capital, fertilizer, insecticide, extension, etc.) and nonconventional inputs (education, age, nationality, and gender of household head), was developed to evaluate the productivity of factors of production. The result of the

production function analysis indicated that land was the most important variable, contributing the most to farm output. Further analysis indicated that farm size is the most important variable influencing technology adoption. Capital, electricity, and technical agents in the village also have important impacts on the use of fertilizer, insecticide, and/or farm equipment.

A study by Ramaswamy, Sunder (1991) focused on assessing the impact of technological change on land use patterns and household income distribution in the sahel. The study was directed toward the determination of whether the introduction of highly profitable agricultural technologies could make the farm household and the women better off.

In 1990, Cao Fengshan conducted a study to determine who benefits from technology transfer between developed and less developed countries. The lower cost of transfer was compared with the cost of local development which leads to a profitable transfer for a recipient country. An empirical analysis of the U.S.-Mexico agricultural technology transfer showed that both Mexico and the United States benefitted from the technology transfer.

Another study focusing on the impact of new agricultural technology on income distribution in the Nepalese Tarai was done by Ganesh Bahadur Thapa (1989). The focus of this research was on the assessment of the differential impact of modern technology on income levels and income distribution in

an irrigated village where new technology has been widely adopted, and in a village where technology adoption has been limited by the lack of irrigation. The impact of new technology on returns to land was analyzed by the estimation of factor and earner shares of income and subsequently by the estimation of household income determination functions. A significantly higher share of land and operator's surplus was observed in Anandban. The simulation of Gini coefficients using the results of household income determination functions showed that income distribution in Anandban deteriorated primarily due to the worsening of rice income distribution after technological change. An analysis of the demand for labor showed that new technology had a positive impact on employment, particularly for hired labor. Despite an increase in returns to labor due to technological change, labor's share of returns declined in the irrigated village.

In a similar study, Keith Fuglie (1989) investigated the development and spread of modern rice production technology in the northeast region of Thailand, an area noted for low agricultural productivity and an unfavorable rice growing environment. In this study, over 200 farmers were interviewed to determine the extent of diffusion of modern varieties, fertilizer and farm machinery. Over 90 percent of the sample who had adopted modern rice varieties tended to be farmers with above average education, access to institutional credit, and below average-farm size. A measure of the farmer's

attitude toward risk taking did not have a significant effect on the initial adoption decision.

James M. Harder investigated the relationship between institutional incentives and technology adoption (1989). The study tested the hypothesis that peasant technology adoption decisions are guided by incentives embodied in economic, social, and political institutions which determine the smallholder environment. A relatively low animal draft technology (ADT) adoption rate was seen to be due to an overall hostile institutional incentive environment to that technology, especially in the region's marketing systems.

Akinwumi Ayodeji Adesina (1988), investigated farmer behavior and new agricultural technologies in the rain-fed agriculture of Southern Niger. The results showed that (a) farmers adopted early maturing cultivars in low rainfall years but used late seasons cultivars in higher rainfall years. (b) Adoption of the technologies increased household nutritional positions, expected total farm incomes, and returns to labor. (c) The adoption of early maturing varieties reduced the variability of incomes received by farmers.

Mya Maung (1989), examined the strengths and weaknesses of the agricultural extension model in Burma. Based on the analysis of the strengths and weaknesses of the Burmese extension system, recommendations made included an emphasis on the establishment of a system for technology development and transfer in Burma by modifying the existing extension system.

Summary of Literature Review

In summary, the literature review focused on the past and current level of agricultural development in developing countries with particular emphasis on technology development and transfer and the need for future replacement of the current level of poor and stagnant technology in use in many developing countries. Much of the review of literature centered on the historical backgrounds of traditional and existing agricultural production systems in developing countries with particular reference to Africa. In the literature review noted some outstanding innovations and changes in output level resulting from on-going research in many developing countries including parts of Africa and the adoption of modern irrigation systems in parts of Asia were cited.

Several research studies directed toward agricultural technology development and transfer in many developing countries were cited in the review of literature; most of these studies were centered on modern agricultural technology adoption and the results of many of the studies showed positive attitudes by farmers in modern technology adoption.

The literature review discussed agricultural policies and practices in many developing countries, outlining major credit problems and input delivery obstacles. Technical assistance and technology transfer to developing countries were also

major issues of literature review focusing on means of technology transfer to developing countries.

CHAPTER III

PROCEDURES AND METHODOLOGY

Introduction

The purpose of this chapter is to describe the procedures and methodology for conducting the study and analyzing the results. To collect and interpret information from agricultural faculty from Mid-America International Agricultural Consortium (MIAC) institutions who participated in this study, the researcher had to accomplish the following procedures: determine population for the study; develop the instrument for collecting data; determine the procedure for collecting data; and determine the statistical treatment used to analyze data. Information for this study was collected during the Fall Semester 1993.

Institutional Review Board

Federal regulations and Oklahoma State University policy require review and approval of all research studies involving human subjects before researchers can conduct their research. This review and approval procedure by the Oklahoma State University Office of Research Services and Institutional Review Board is to protect the rights and welfare of human

subjects involved in biomedical and behavioral research. In compliance with the above mentioned policy, this study received proper surveillance and was granted permission to proceed. The approval sheet from IRB is included in Appendix A.

Population

To determine the population of this study, the OSU Center for International Trade Development (CITD) was consulted. The list of institutions making up Mid America International Agricultural Consortium (MIAC) was provided by CITD. MIAC institutions were chosen for this survey because of their past and current involvement in international agricultural development activities. These institutions include: Iowa State University, Ames, Iowa; the University of Nebraska, Lincoln, Nebraska; University of Missouri, Columbia, Missouri; Kansas State University, Manhattan, Kansas and Oklahoma State University, Stillwater, Oklahoma. Coordinators of international Agricultural programs in the aforementioned institutions were contacted in writing and were requested to furnish the investigator with names and addresses of agricultural professors in their respective institutions with experience in international agricultural development in developing countries.

Thus the population of this study consisted of agricultural professors from Mid America International

Agricultural Consortium (MIAC) institutions who have had any involvement in agricultural development in a developing country within the past five years. A questionnaire was developed and mailed directly to each respondent in his/her institution.

Development of the Instrument

In the preparation of the instrument (see Appendix B), special attention was given to achievement of the objectives of the study. Several instruments were reviewed by the investigator. The choice of a mailed questionnaire was considered appropriate in order to obtain higher percentage of responses for both quantitative and qualitative data and for its advantages of economy, uniformity of questions and standardization (Key, 1988. Research Design). The questionnaire format and face validity (wording and questioning sequence) reflected the following characteristics: Important, short and to the point, well sequenced and neatly arranged questions to produce the required data.

The instrument consisted of four major sections. Section one of the instrument sought respondents' background such as name of employer, area of expertise and academic rank. Section two of the instrument was devoted to determining respondents' experiences in developing countries with regard to extent of involvement, interest and nature of assignment. Section three of the instrument sought to determine

respondents' perceptions of the importance of selected agricultural technology with regard to the achievement of sustainable agriculture in developing countries. Questions in section four of the instrument were designed to determine respondents' perceptions regarding the impact of selected agricultural technology on output level in developing countries. A blank space at the end of the questionnaire was provided for respondents to include other professional experiences that they might have had. There were on the whole a total of thirty-two questions including the comment question at the end of the questionnaire.

With the exception of questions in section one that sought respondents' background information and the comment question at the end of the instrument, all questions in the instrument utilized Likert-type scales to measure level of responses. The instrument was pilot-tested with international doctoral students and then with staff of the OSU Center for International Trade Development for content validity and applicability. Suggestions and corrections from students and staff of CITD were incorporated to further refine the instrument prior to its distribution.

Collection of Data

The completed questionnaire, along with a letter signed by the researcher and the researcher's principal advisor, were mailed directly to each of the respondents' identified from

the five institutions from which participants were sought for the study. The questionnaire included a cover letter which clearly stated the scope and purpose of the study and a stamped, self-addressed envelope for return of the questionnaire.

Initial mailing of questionnaires was in the first week of October 1993. By the last week of November 1993 a total of 76 questionnaires were returned and these accounted for 66% of the 116 questionnaires mailed.

A follow-up letter was mailed in the first week of December 1993 and this effort resulted in increasing the response rate from the initial 66% to 71.5%.

Analysis of Data

The statistical treatment utilized in this research effort consisted of descriptive statistics including frequency distributions, percentages, means and standard deviation. Statistical analysis assistance was provided to the researcher by the OSU Statistics Department utilizing the Statistical Analysis System (SAS) computer program. There were two categories of responses to questions in the instrument: (1) Quantitative type of responses such as: Extremely interested, extremely involved, somewhat involved and "yes" or "no" responses; and (2) Qualitative responses where respondents were offered a medium to provide more elaborative responses to open-ended questions. Mean responses, standard deviations and

qualitative responses were utilized as appropriate bases for analyzing and describing findings and making conclusions. In sections II, III, and IV of the instrument, Likert-type scales were used to elicit responses. The Likert scales utilized and values assigned to each for purposes of interpretation for the various areas investigated were as follows:

1. Level of involvement in developing countries.

   1 = Not at all involved
   2 = Somewhat involved
   3 = Involved
   4 = Very involved
   5 = Extremely involved.

2. Level of interest in future projects in developing countries.

   1 = Not at all interested
   2= Somewhat interested
   3 = Interested
   4 = Very interested
   5 = Extremely interested.

3. Level of importance of selected agricultural technology toward achievement of sustainable agriculture in developing countries.

   1 = Extremely unimportant
   2 = Unimportant
   3 = Important
   4 = Very important
   5 = Extremely important.

4. Level of agreement to statements about developing countries' agricultural technology needs.

   1 = Strongly disagree
   2 = Disagree
   3 = Somewhat agree
   4 = Agree
   5 = Strongly agree.

To facilitate interpretation of calculated mean

responses, ranges of real limits were established for each response category as follows:

Numerical Values of Response Category	Range of Real Limits	Category of Response
1	1.00-1.49	Not at all involved
2	1.50-2.49	Somewhat involved
3	2.50-3.49	Involved
4	3.50-4.49	Very involved
5	4.50-5.00	Extremely involved
1	1.00-1.49	Not at all interested
2	1.50-2.49	Somewhat interested
3	2.50-3.49	Interested
4	3.50-4.49	Very interested
5	4.50-5.00	Extremely interested
1	1.00-1.49	Extremely unimportant
2	1.50-2.49	Unimportant
3	2.50-3.49	Important
4	3.50-4.49	Very important
5	4.50-5.00	Extremely important
1	1.00-1.49	Strongly disagree
2	1.50-2.49	Disagree
3	2.50-3.49	Somewhat agree
4	3.50-4.49	Agree
5	4.50-5.00	Strongly agree

Using the foregoing, a mean response of 3.6 could be interpreted as Very Important, or Very Interested, or Very Involved, or Agree.

CHAPTER IV

PRESENTATION OF FINDINGS AND ANALYSIS OF DATA

Introduction

The primary purpose of this chapter is to present findings of the study. The major purpose of this study was to determine the extent of involvement in developing countries by selected U.S. agricultural professors and their perceptions of current and projected needs regarding agricultural technology. To accomplish the purpose of the study the following objectives were developed:

1. To determine respondents' extent of involvement and sustained interest in agricultural technology development in developing countries.
2. To determine respondents' perceptions with regard to the impact of selected agricultural technology on level of crop and livestock production in many countries.
3. To determine respondents' perceptions as regards the level of importance of selected agricultural technology with respect to achievement of sustainable agriculture in developing countries.

Data for this research effort were collected from Agricultural professors from Mid-America International Agricultural Consortium (MIAC) institutions who have had experience in international agricultural development in a developing country. The population consisted of a purposive sample from five MIAC institutions as follows: University of Missouri (MU), Columbia; University of Nebraska (NU), Lincoln; Kansas State University (KSU), Manhattan; Iowa State University (ISU), Ames; and Oklahoma State University (OSU), Stillwater.

The instrument used to collect data from the population of this study was divided into four sections. Section one of the instrument asked for respondents demographic information such as name of employer, academic rank, and sex. Section two of the instrument was designed to determine respondents' nature of assignment in a developing country and their level of interest in future agricultural development projects in developing countries. Section three was designed to determine perceptions of respondents with regard to importance of selected agricultural technology toward the achievement of sustainable agriculture in developing countries. Section four of the instrument was devoted to respondents' perceptions of the impact of selected agricultural technology on output level in developing countries. These four sections provided logical sub-headings within this chapter for the presentation of data collection.

Demographic Data

Background of Population

The population of this study included 116 agricultural faculty from five member institutions of Mid-America International Agricultural Consortium (MIAC). Of the 116 questionnaires mailed out, 83 were returned and these accounted for a 71.5% rate of return. Figure 1 is a presentation of percentage of total response by sex. The figure illustrates that male responses represented 95.18% of total response while the remaining 4.82% were female.

Figure 2 is a presentation of total respondents by institutions. Of the 83 persons who provided valid responses, 28 (34.57%) came from OSU; 27 (33.33%) from ISU, 10 (12.35%) from NU, 9 (11.11%) from MU, 6 (7.41%) from KSU and 1 was not identified. Of the total returned questionnaires, two did not indicate name of employer institution. Those comprised the "other" category in the figure.

Figure 3 is a depiction of the percentage of total respondents by academic rank. As indicated in Figure 3, 64 (77.11%) of the total respondents were full professors, 11 (13.25%) associate, 3 (3.61%) assistant, and 5 (6.02%) did not indicate their academic rank.

The percentage of total respondents by area of expertise is represented in Figure 4. Of the 83 total responses, 19 (22.89%) were Agricultural economists, 16 (19.28%) were

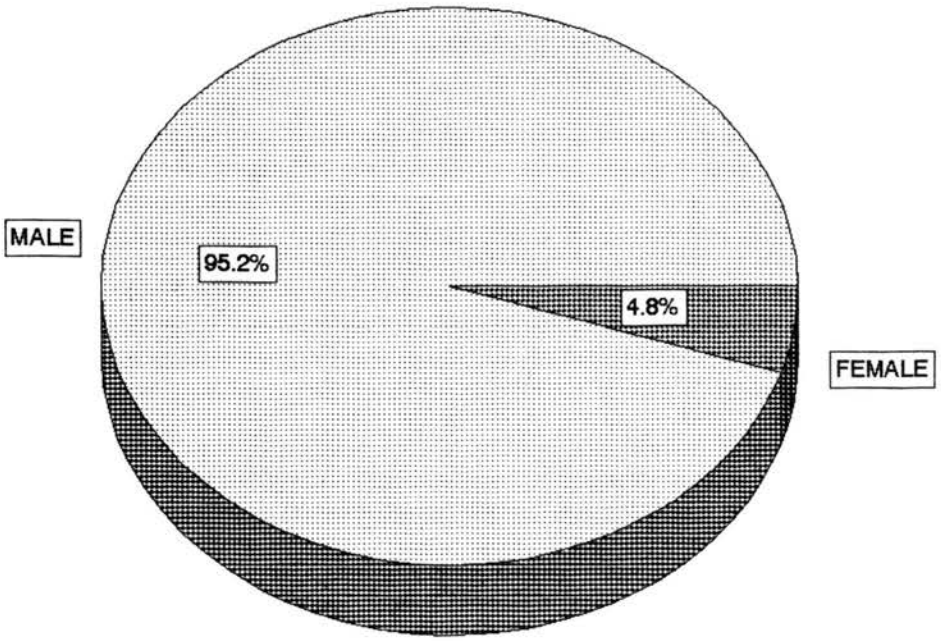

Figure 1. Percentage of Total Response by Sex

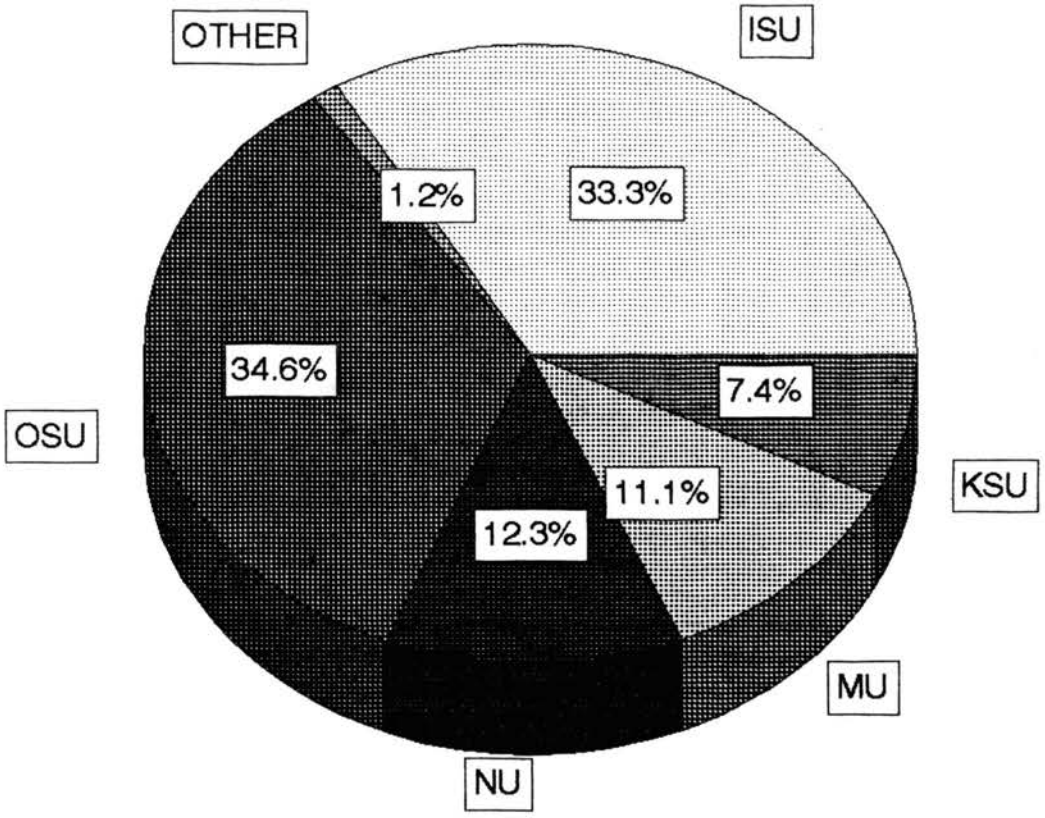

Figure 2. Percentage of Total Respondents by Institution

Interpretations of Abbreviations:

KSU = Kansas State University
ISU = Iowa State University
OSU = Oklahoma State University
NU = University of Nebraska
Other = Other Ranks

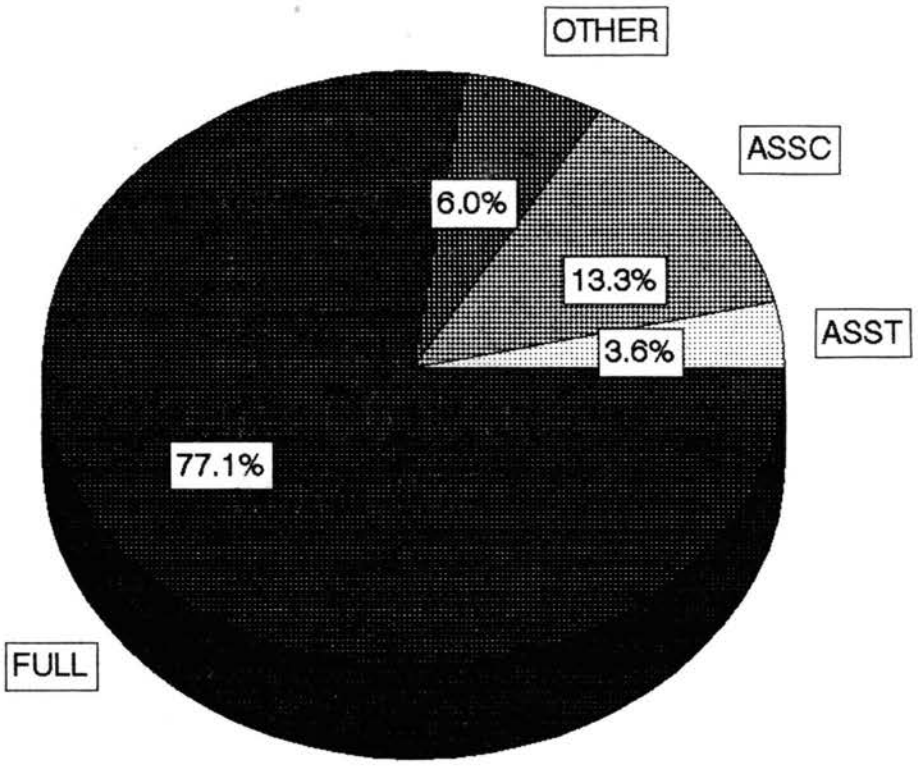

Figure 3. Percentage of Total Respondents by Academic Rank

Interpretation of Abbreviations:

ASST = Assistant Professor
ASSOC = Associate Professor
FULL = Full Professor
OTHER = Other Ranks

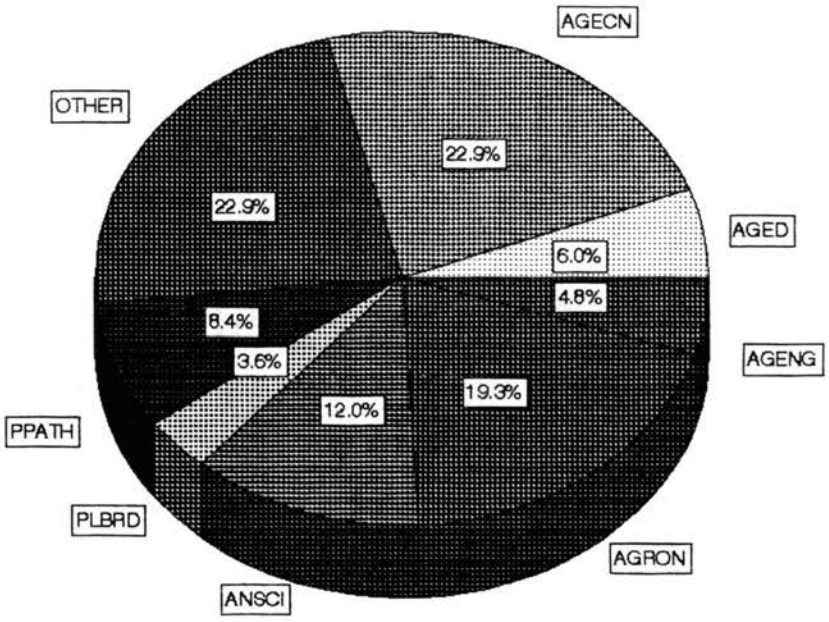

Figure 4. Percentage of Total Respondents by Area of Expertise

Interpretation of Abbreviations:

AGRON = Agronomy
AGENG = Agricultural Engineering
AGED = Agricultural Education
AGECN = Agricultural Economics
OTHER = Other Areas of Expertise
PPATH = Plant Pathology
PLBRD = Plant Breeding
ANSCI = Animal Science

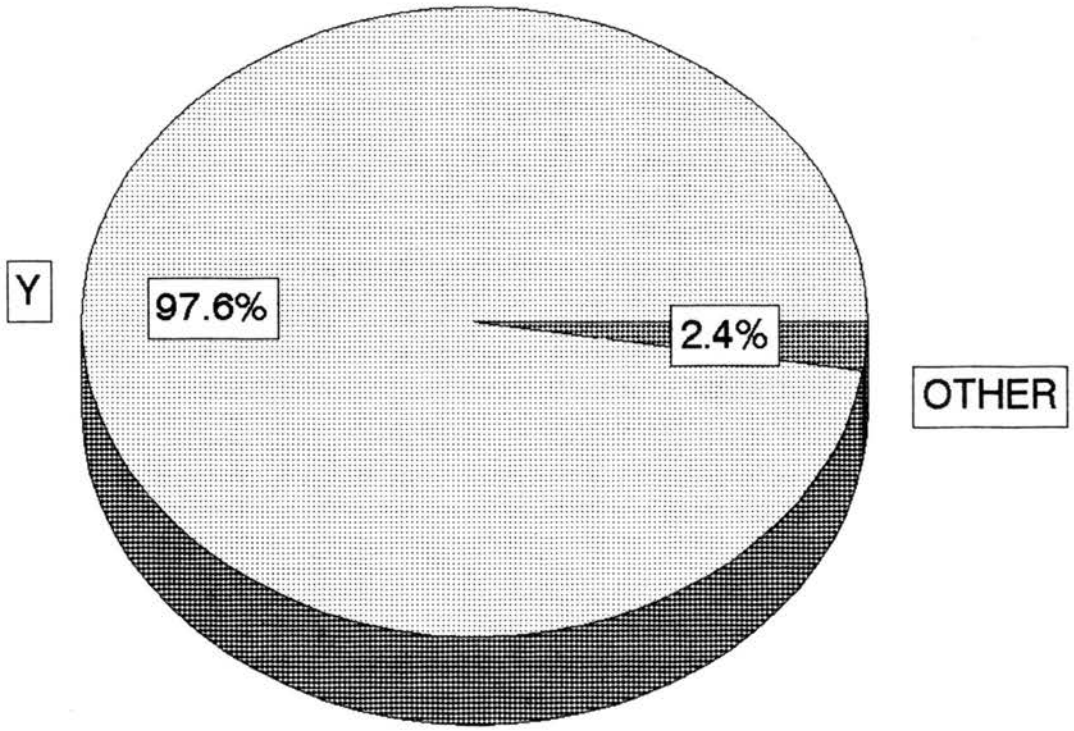

Figure 5. Percentage of Respondents Regarding Experience in Agricultural Development in a Developing Country

Interpretation of Abbreviations:

Y = Yes
Other = No or Missing Response

agronomists, 10 (12.05%) were animal scientist, 7 (8.43%) were plant pathologists, 5 (6.02%) were agricultural educators, 4 (4.82%) were agricultural engineers, 3 (3.61%) were plant breeders and 19 (22.89%) did not specify their area of expertise.

Represented in Figure 5 is percentage of respondents' regarding experience in a developing country. Of the total of 83 respondents received, 80 (97.56%) indicated that they have had some experience in agricultural development in a developing country, 2 (2.44%) did not indicate yes or no, while one response was missing.

Table I contains a listing of countries identified by respondents' as the site of their most recent international agricultural development experience. Morocco was named by nine respondents as the country of their most recent agricultural assignment in a developing country, followed by Kenya which was named by seven respondents. All the remaining had been visited by the number of respondents as shown in the table. This represents the number not identifying their countries of most recent international agricultural experience.

Involvement and Interest in Developing Countries

Presented in Table II are respondents' ratings of their experiences in their most recent agricultural assignments in

a developing country. Of the 81 respondents who answered this question, 6.2% rated their experiences as Interesting,

TABLE I

LIST OF COUNTRIES WHERE RESPONDENTS HAD THEIR MOST RECENT AGRICULTURAL DEVELOPMENT ASSIGNMENT

Country	Frequency (No. of Respondents/ Country)	Cumulative Percent
Albania	1	1.3
Botswana	2	3.8
Bulgaria	1	5.1
China	3	9.0
Colombia	1	10.3
Costa Rica	4	15.4
Czech Rep	1	16.7
Dominican Rep	1	17.9
Egypt	1	19.2
El Salvador	3	23.1
Ethiopia	2	25.6
Finland	1	26.9
Guatemala	2	29.5
Honduras	2	32.1
Hungary	1	33.3
India	1	34.6
Indonesia	3	38.5
Kenya	7	47.4
Latvia	1	48.7
Mali	3	52.6
Mexico	4	57.7
Morocco	9	69.2
Nigeria	1	70.5
Pakistan	4	75.6
Peru	3	79.5
Poland	1	80.8
People's Republic of China	1	82.1
Saudi Arabia	2	84.6
Senegal	1	85.9

TABLE I (Continued)

Country	Frequency (No. of Respondents/ Country)	Cumulative Percent
South Africa	1	87.2
Sri Lanka	1	88.5
Thailand	3	92.3
Tunisia	1	93.6
Turkey	1	94.9
Uganda	1	96.2
Vietnam	1	97.4
Yucatan	1	98.7
Zambia	1	
Total	100	100

TABLE II

RESPONDENTS' RATINGS OF THE QUALITY OF EXPERIENCES IN THEIR MOST RECENT AGRICULTURAL DEVELOPMENT ASSIGNMENTS IN A DEVELOPING COUNTRY

Quality of Experiences	Distribution of Responses	
	Frequency	Percent
Extremely Uninteresting	--	--
Uninteresting	--	--
Interesting	5	6.1
Very Interesting	31	38.3
Extremely Interesting	45	55.6
Total	81	100

N = 81, Mean = 4.49, SD = 0.61 Mean Response = Very Interesting

38.3% rated their experience as Very Interesting while the remainder 55.6% rated their experience as Extremely Interesting. A mean response of 4.49 and a standard deviation of 0.61 were calculated for responses to this item. This calculated mean response of 4.49 was interpreted as "Very Interesting."

Table III is a presentation of data on respondents' ratings of their interest in taking up future agricultural development assignments in a developing country. Of the 83 respondents who responded to this question, only one (1.2%) was Not At All Interested in taking up future agricultural development assignments in a developing country, five (6.1%) were Somewhat Interested; 13 (15.9%) were Interested, 30 (36.6%) were Very Interested and the remaining 33 (40.2%) were Extremely Interested. A 4.085 mean response and 0.96 standard deviation were calculated for this comparison. The calculated mean response of 4.085 was interpreted as "Very Interested."

TABLE III

RESPONDENTS' RATINGS OF THEIR LEVELS OF INTEREST IN TAKING UP FUTURE AGRICULTURAL DEVELOPMENT ASSIGNMENTS IN A DEVELOPING COUNTRY

Levels Of Interest	Distribution of Responses	
	Frequency	Percent
Not At All Interested	1	1.2
Somewhat Interested	5	6.1
Interested	13	15.9
Very Interested	30	36.6
Extremely Interested	33	40.2
Total	82	100

N = 82, Mean = 4.08, SD = 0.95, Mean Response = Very Interested

Data reported in Table IV are respondents' ratings of their levels of involvement in the social and cultural aspects of their host countries while on assignment. One (1.2%) respondent indicated he/she was Not At All Involved in the social and cultural aspects of the host country. Seventeen (21.0%) thought they were Somewhat Involved; 24 (29.6%) thought they were Involved; 29 (35.8%) thought they were Very Involved while the other 10 (12.3%) thought they were Extremely Involved. Two respondents did not rate their level of involvement. The mean response calculated for this was

3.37 and the standard deviation was 0.99. The calculated mean response of 3.37 represented "Involved."

TABLE IV

RESPONDENTS' RATING OF THEIR LEVELS OF INVOLVEMENT IN THE SOCIAL AND CULTURAL ASPECTS OF THEIR HOST COUNTRY

Levels of Involvement	Distribution of Responses	
	Frequency	Percent
Not At All Involved	1	1.2
Somewhat Involved	17	21.0
Involved	24	29.6
Very Involved	29	35.8
Extremely Involved	10	12.3
Total	81	100

N = 81, Mean = 3.37, SD = 0.99, Mean Response = Involved

Presented in Table V are data relating to the number of times respondents have been involved in agricultural development projects in a developing country. The table provides details as to the distribution of respondents by number of times involved. One respondent had no response to this item. The range of number of times involved reported by

respondents was from 0 to 99. The modal response was two involvements. Overall, the 82 respondents had a total of 1359 assignments in developing countries, for a mean of 16.57 per individual. Interestingly, five respondents indicated they had served in developing countries 99 times each. This group contributed substantially to the magnitude of the mean number of involvements. Only they and 15 other individuals reported a number of involvements above the mean.

TABLE V

NUMBER OF TIMES RESPONDENTS HAVE BEEN INVOLVED IN AGRICULTURAL DEVELOPMENT ASSIGNMENTS IN A DEVELOPING COUNTRY

Number of Involvements	Distribution of Responses	
	Frequency	Percent
0	1	1.2
1	7	8.5
2	11	13.4
3	4	4.9
4	7	8.5
5	7	8.5
6	2	2.4
7	2	2.4
8	6	7.3
9	3	3.7
10	5	6.1
12	3	3.7
14	1	1.2
15	3	3.7
19	1	1.2
20	3	3.7
25	3	3.7
30	3	3.7
37	1	1.2

TABLE V (Continued)

Number of Involvements	Distribution of Responses Frequency	Percent
50	2	2.4
56	1	1.2
77	1	1.2
99	5	6.1
Total		100

N = 82, Mean = 16.57, SD = 25.10

Table VI contains a summary of responses as to whether or not respondents most recent assignment in a developing country involved teaching. Of the 58 who responded to this item, 15 (25.9%) said they were not at all involved in teaching; eight (13.8%) considered themselves Somewhat Involved, another 8 (13.8%) indicated they were Involved. 12 (20.7%) were Very Involved and the other, 15 (25.9%) were Extremely Involved in teaching. For this comparison, a mean response of 3.07 and a standard deviation of 1.57 were calculated. The calculated mean of 3.07 fell into the classification of "Involved."

TABLE VI

THE EXTENT TO WHICH RESPONDENTS' MOST RECENT ASSIGNMENTS IN A DEVELOPING COUNTRY INVOLVED TEACHING

Extent of Involvement	Frequency	Percent
Not At All Involved	15	25.9
Somewhat Involved	8	13.8
Involved	8	13.8
Very Involved	12	20.7
Extremely Involved	15	25.9
Total	58	100

N = 58, Mean = 30.7, SD = 1.57, Mean Response = Involved

In Table VII, data on respondents' ratings of the extent to which their most recent assignment in a developing country involved research and development are presented. Seventy-one of the 83 total respondents answered this question. Three individuals (4.2%) indicated they were Not At All Involved in research, Six people (8.5%) felt they were Somewhat Involved. Thirteen (18.3%) responded at the Involved level, while 22 (31.9%) reported being Very Involved. The 27 remaining faculty members, (38.0%) had been Extremely Involved in research and development. The calculated mean response was 3.90 and a standard deviation of 1.14. The mean response of

3.90 translated to "Very Involved" for the group as a whole.

TABLE VII

THE EXTENT TO WHICH RESPONDENTS' RECENT AGRICULTURAL ASSIGNMENTS IN A DEVELOPING COUNTRY INVOLVED RESEARCH/DEVELOPMENT

Extent of Involvement	Frequency	Percent
Not At All Involved	3	4.2
Somewhat Involved	6	8.5
Involved	13	18.3
Very Involved	22	31.0
Extremely Involved	27	38.0
Total	71	100

N = 71, Mean = 3.90, SD = 1.35, Mean Response = Very Involved

Table VII was developed to present the data regarding respondents' ratings of the extent to which their most recent agricultural development assignment in a developing country involved extension. A total of 56 responded to this question. Of these, 19.6% were Not At All Involved with extension on their most recent travel to a developing country. Almost one-third (30.4%) were Somewhat Involved, while another ten

(17.9%) were Involved, ten more (17.9%) were Very Involved and the remaining eight (14.3%) were Extremely Involved in extension. The mean response and standard deviation calculated were 2.77 and 1.35 respectively. This mean response of 2.77 translated to "Involved."

TABLE VIII

RESPONDENTS RATINGS OF THE EXTENT TO WHICH THEIR MOST RECENT AGRICULTURAL ASSIGNMENTS IN A DEVELOPING COUNTRY INVOLVED EXTENSION

Extent of Involvement	Frequency	Percent
Not At All Involved	11	19.6
Somewhat Involved	17	30.4
Involved	10	17.9
Very Involved	10	17.9
Extremely Involved	8	14.3
Total	56	100

N = 56, Mean = 2.77, SD = 1.35, Mean Response = Involved

Reported in Table IX are data on respondents' ratings of the extent to which their most recent agricultural assignment in a developing country involved activities other than

teaching, research and development or extension. Of the total of 83 respondents, 21 answered this question. Of these, nine (42.9%) thought they were Not At All Involved, four (19.0%) were Very Involved and the other eight, (38.1%) were Extremely Involved in activities other than teaching, research and development or extension. Calculated mean response and standard deviation were 3.09 and 1.89 respectively. A mean response of 3.09 was interpreted as "Involved."

TABLE IX

RESPONDENTS' RATING OF THE EXTENT TO WHICH THEIR MOST RECENT AGRICULTURAL ASSIGNMENTS IN A DEVELOPING COUNTRY INVOLVED ACTIVITIES OTHER THAN TEACHING OR RESEARCH OR EXTENSION

Extent of Involvement	Frequency	Percent
Not At All Involved	9	42.9
Somewhat Involved	--	---
Involved	--	---
Very Involved	4	19.0
Extremely Involved	8	38.1
Total	21	100

N = 21, Mean = 3.09, SD = 1.89, Mean Response = Involved

Figure 6 was developed to depict the percentage of respondents by type of project in which they were involved with respect to their most recent assignment in a developing country. 16.05% of the respondents were involved in a livestock development project, 19.75% were in soil/agronomic project, 49.38% were in other projects, 12.35% were involved in extension/teacher training projects while the remainder, 2.47% were fishery/water/University establishment projects.

Perceptions as Regards The Achievement of Sustainable Agriculture

In Table X, data regarding respondents' perceptions of the importance of disease resistant varieties of crops and livestock to the achievement of sustainable agriculture in developing countries are presented. Of the 82 respondents to this question, two (2.4%) thought that disease resistant varieties of crops and livestock were Unimportant, 18 (22.0%) thought they were Important, and 31 (37.8%) thought they were Very Important and 37.8% thought they were Extremely Important respectively. The mean response and standard deviation calculated were 4.11 and 0.83 respectively. The mean response of 4.11 was translated as "Very Important."

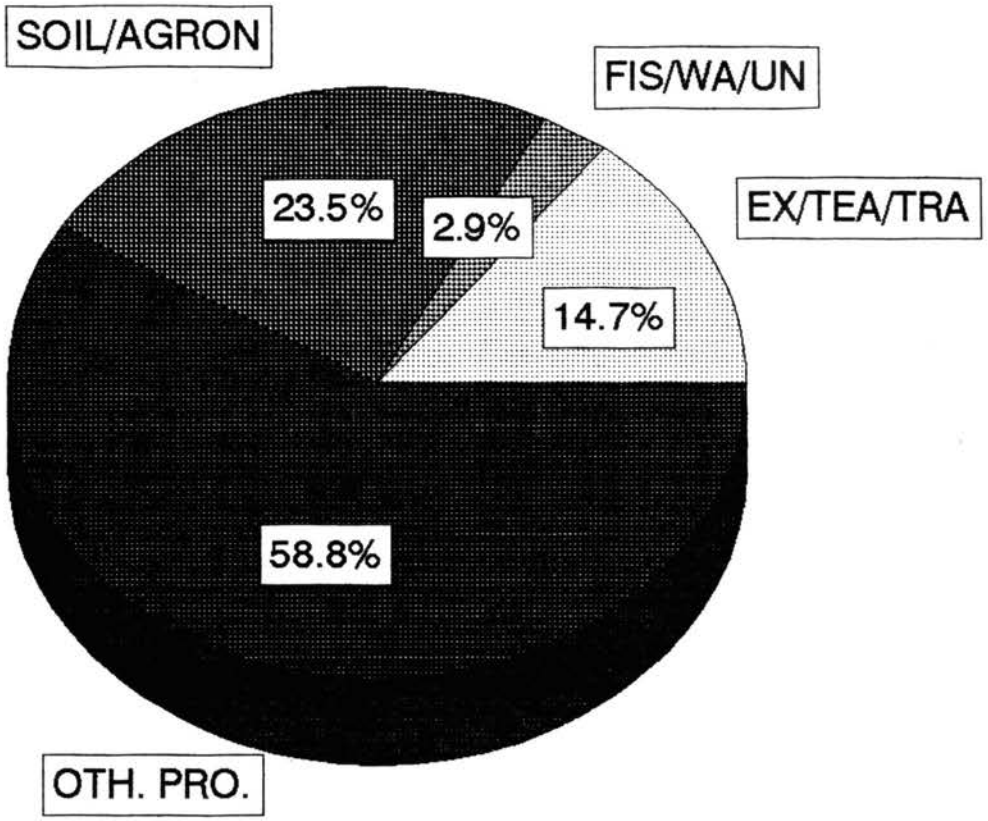

Figure 6. Percentage of Respondents by Project Category in Which They Were Involved on Their Most Recent Travel to A developing Country

Interpretations of Abbreviations:

EX/TEA/TRA = Extension/Teacher Training Projects
FIS/WA/UN = Fishery/Water/University Establishment
SOIL/AGRON = Soil/Agronomic Projects
OTH. PRO. = Other Projects

Data presented in Table XI are respondents' perceptions of the importance of high yielding varieties of crops and livestock to the achievement of sustainable agriculture in developing countries. Of those responding to this item, three (3.7%) perceived high yielding varieties of crops and livestock to be Unimportant. Twenty-seven (32.9%) perceived such varieties as Important, while 31 (37.8%) perceived them to be Very Important. The other 21 respondents, (25.6%) perceived it to be Extremely Important to the achievement of sustainable agriculture in developing countries to have high yielding varieties of crops and livestock. The calculated mean response and standard deviation were 3.85 and 0.85 respectively. The mean response of 3.85 translated to "Very Important."

TABLE X

PERCEPTIONS OF THE IMPORTANCE OF DISEASE RESISTANT VARIETIES OF CROPS AND LIVESTOCK TO THE ACHIEVEMENT OF SUSTAINABLE AGRICULTURE IN DEVELOPING COUNTRIES

Degree of Importance	Distribution of Responses	
	Frequency	Percent
Extremely Unimportant	--	--
Unimportant	2	2.4
Important	18	22.0

TABLE X (Continued)

Degree of Importance	Distribution of Responses: Frequency	Percent
Very Important	31	37.8
Extremely Important	31	37.8
Total	82	100

N = 82, Mean = 4.11, SD = 0.83, Mean Response = Very Important

TABLE XI

PERCEPTIONS OF THE IMPORTANCE OF HIGH YIELDING VARIETIES OF CROPS AND LIVESTOCK TO THE ACHIEVEMENT OF SUSTAINABLE AGRICULTURE IN DEVELOPING COUNTRIES

Degree of Importance	Distribution of Responses: Frequency	Percent
Extremely Unimportant	--	--
Unimportant	3	3.7
Important	27	32.9
Very Important	31	37.8
Extremely Important	21	25.6

N = 82, Mean = 3.85, SD = 0.85, Mean Response = Very Important

Presented in Table XII are respondents' perceptions with regard to the importance of increased utilization of sprinkler irrigation equipment and efficient water management programs to the achievement of sustainable agriculture in developing countries. Sprinkler irrigation and efficient water management were rated as Extremely Unimportant by five (6.3%) of the 79 respondents. These practices were perceived as Unimportant by ten (12.7%) of those responding. A rating of Important was the judgment of 42 (53.2%) of the respondents, while 13 (16.5%) assigned a rating of Very Important. Only nine (11.4%) felt these practices were Extremely Important. With a calculated mean response of 3.14, the groups of respondents combined assigned rating of "Important" to these practices. The standard deviation for this area was found to be .99.

TABLE XII

PERCEPTIONS OF THE IMPORTANCE OF INCREASED UTILIZATION OF SPRINKLER IRRIGATION EQUIPMENT AND EFFICIENT WATER MANAGEMENT TO THE ACHIEVEMENT OF SUSTAINABLE AGRICULTURE IN DEVELOPING COUNTRIES

Degree of Importance	Distribution of Responses	
	Frequency	Percent
Extremely Unimportant	5	6.3
Unimportant	10	12.7

TABLE XII (Continued)

Degree of Importance	Distribution of Responses Frequency	Percent
Important	42	53.2
Very Important	13	16.5
Extremely Important	9	11.4
Total	79	100

N = 79, Mean = 3.14, SD = .99, Mean Response = Important

Data reported in Table XIII are respondents' perceptions regarding the importance of improved planting, tillage and harvesting equipment in the achievement of sustainable agriculture in developing countries. Nine (11.3%) rated planting, tillage and harvesting equipment to be Unimportant, thirty-nine (48.7%) of those responding assigned a rating of Important, twenty-three (28.8%) assigned a rating of Important. Extremely Important was the perception of the remaining nine (11.3%) of those responding. Combined, those responding to this item rated these practices as "Important." 0.83 was the standard deviation calculated for this item.

TABLE XIII

PERCEPTIONS OF THE IMPORTANCE OF IMPROVED PLANTING, TILLAGE AND HARVESTING EQUIPMENT TO THE ACHIEVEMENT OF SUSTAINABLE AGRICULTURE IN DEVELOPING COUNTRIES

Rating Scale	Distribution of Responses Frequency	Percent
Extremely Unimportant	--	--
Unimportant	9	11.3
Important	39	48.7
Very Important	23	28.8
Extremely Important	9	11.3
Total	80	100

N = 80, Mean = 3.4, SD = 0.83, Mean Response = Important

In Table XIV are presented data representing respondents' perceptions of the importance of replacing animal powered with engine powered farm equipment to the achievement of sustainable agriculture in developing countries. The judgment of two (2.5%) of the group responding to this item was Extremely Unimportant, 27 (33.3%) assigned a rating of "Unimportant." The rating of thirty-six (44.4%) of the group was Important while fourteen (17.3%) perceived it to be Very Important. The remaining two (2.5%) felt this practice was Extremely Important. The perception of the group combined was

a rating of Important. For this area, 0.83 standard deviation was calculated.

TABLE XIV

PERCEPTIONS OF THE IMPORTANCE OF REPLACING ANIMAL POWERED WITH ENGINE POWERED FARM EQUIPMENT TO THE ACHIEVEMENT OF SUSTAINABLE AGRICULTURE IN DEVELOPING COUNTRIES

Degree of Importance	Frequency	Percent
Extremely Unimportant	2	2.5
Unimportant	27	33.3
Important	36	44.4
Very Important	14	17.3
Extremely Important	2	2.5
Total	81	100

N = 81, Mean = 2.83, SD = 0.83, Mean Response = Important

Reported in Table XV are data representing respondents' perceptions of the importance of increased use of agri-chemicals (pesticides, fungicides and herbicides) to the achievement of sustainable agriculture in developing countries. Of those responding to this question, two rated

(2.5%) agri-chemicals to be Extremely Unimportant. Unimportant was the rating assigned by twenty-three (28.8%) of the group. Forty-one (51.2%) of the group rated this item Important while thirteen (16.3%) felt the practice was Very Important. Only one respondent (1.3%) assigned a rating of "Extremely Important." 0.76 standard deviation was calculated for this item. The group rating of this practice was "Important."

TABLE XV

PERCEPTIONS OF THE IMPORTANCE OF INCREASED USE OF AGRI-CHEMICALS (PESTICIDES, FUNGICIDES, AND HERBICIDES) TO THE ACHIEVEMENT OF SUSTAINABLE AGRICULTURE IN DEVELOPING COUNTRIES

Degree of Importance	Frequency	Percent
Extremely Unimportant	2	2.5
Unimportant	23	28.8
Important	41	51.2
Very Important	13	16.3
Extremely Important	1	1.3
Total	80	100

N = 80, Mean = 2.85, SD = 0.76, Mean Response = Important

Presented in Table XVI are data regarding respondents' perceptions of the importance of introducing new technology consistent with reducing soil loss from wind erosion in the achievement of sustainable agriculture in developing countries. Extremely Unimportant was the judgment of one respondent of the total responding while fourteen (17.3%) assigned a rating of Unimportant to the practice. A rating of Important was assigned by seventeen (21.0%) of the group and thirty-one (38.3%) perceived the practice to be Very Important. The remaining eighteen (22.2%) rated it as Extremely Important. "Very Important" was the resultant group rating. 1.05 was the standard deviation calculated.

TABLE XVI

PERCEPTIONS OF THE IMPORTANCE OF INTRODUCING NEW TECHNOLOGY CONSISTENT WITH REDUCING SOIL LOSS FROM WIND EROSION TO THE ACHIEVEMENT OF SUSTAINABLE AGRICULTURE IN DEVELOPING COUNTRIES

Degree of Importance	Frequency	Percent
Extremely Unimportant	1	1.2
Unimportant	14	17.3
Important	17	21.0
Very Important	31	38.3

TABLE XVI (Continued)

Degree of Importance	Frequency	Percent
Extremely Important	18	22.2
Total	81	100

N = 81, Mean = 3.63, SD = 1.05, Mean Response = Very Important

Data presented in Table XVII are respondents' perceptions of the importance of technological innovations to control soil erosion from runoff of heavy rainstorms. Two (2.5%) of those responding assigned a rating of Extremely Unimportant to this item while the same item was perceived by seven (8.5%) to be Unimportant. For the same item, the judgment of twenty-one (26.3%) of the group was Important and another twenty-one (26.3%) of the group assigned a rating of Very Important. Twenty-nine (36.2%) of the group responding thought the practice was Extremely Important. As a group their response was "Very Important." The standard deviation calculated was 1.09.

TABLE XVII

PERCEPTIONS OF THE IMPORTANCE OF TECHNOLOGICAL INNOVATIONS TO CONTROL SOIL EROSION FROM RUNOFF OF HEAVY RAINSTORMS TO THE ACHIEVEMENT OF SUSTAINABLE AGRICULTURE IN DEVELOPING COUNTRIES

Degree of Importance	Frequency	Percent
Extremely Unimportant	2	2.5
Unimportant	7	8.5
Important	21	26.3
Very Important	21	26.3
Extremely Important	29	26.3
Total	80	100

N = 80, Mean = 3.85, SD = 1.09, Mean Response = Very Important

Table XVIII are data representing respondents' perceptions of the importance of better storage facilities for seeds and grains to the achievement of sustainable agriculture in developing countries. Only one (1.3%) of those responding to this question perceived better storage facilities to be Extremely Unimportant. Five (6.2%) perceived the item to be Unimportant. Seventeen (21.3%) assigned a rating of Important to the item while thirty-nine (43.7%) rated the practice as Very Important. Extremely Important was the perception of the remaining twenty-two (27.5%) of the group. As a group

their rating was "Very Important." The standard deviation calculated for this item was 0.92.

TABLE XVIII

PERCEPTIONS OF THE IMPORTANCE OF DEVELOPMENT AND THE USE OF BETTER STORAGE FACILITIES FOR DRYING SEEDS AND GRAINS IN DEVELOPING COUNTRIES

Degree of Importance	Frequency	Percent
Extremely Unimportant	1	1.3
Unimportant	5	6.2
Important	17	21.3
Very Important	35	43.7
Extremely Important	22	27.5

N = 80, Mean = 3.9, SD = 0.92, Mean Response = Very Important

The last question in this section asked respondents to list and rate other technologies that they consider crucial to sustainable agricultural development in developing countries. However, this last question received little or no response to be analyzed.

Perceptions of the Impact of Selected Agricultural Technology

Data presented in Table XIX represent respondents' level of agreement to the statement, "The present level of agricultural production in many developing countries can be expanded through better infrastructure (roads, bridges, electricity)." Based on the five-point scale used in this section, one respondent (1.2%) of those responding Disagreed with this statement, fourteen (17.1%) Somewhat Agreed, while forty (48.8%) Agreed. The remaining twenty-seven (32.9%) Strongly Agreed. The judgment of the group combined was "Agree." The standard deviation calculated for this area was 0.73.

TABLE XIX

LEVEL OF AGREEMENT TO THE STATEMENT "THE PRESENT LEVEL OF AGRICULTURAL PRODUCTION IN MANY DEVELOPING COUNTRIES CAN BE EXPANDED THROUGH BETTER INFRASTRUCTURE (ROADS, BRIDGES, ELECTRICITY)."

Level of Agreement	Frequency	Percent
Strongly Disagree	--	--
Disagree	1	1.2

TABLE XIX (Continued)

Level of Agreement	Frequency	Percent
Somewhat Agree	14	17.1
Agree	40	48.8
Strongly Agree	27	32.9
Total	82	100

N = 82, Mean = 4.13, SD = 0.73, Mean Response = Agree

In Table XX is presented level of agreement to the statement "Governments of Developing Countries can increase output level by implementing technology intensive projects in preference to labor intensive projects." Strongly Disagree was the response of three (3.7%) of those responding, twenty-eight (34.6%) of the group Disagreed with the statement. Somewhat Agree was the judgment of thirty-one (38.3%) while eighteen (22.2%) said they Agreed with this item. Only one respondent (1.2%) of the group Strongly Areed. 0.86 was the standard deviation for this item.

TABLE XX

LEVEL OF AGREEMENT WITH THE STATEMENT "GOVERNMENT OF DEVELOPING COUNTRIES CAN INCREASE OUTPUT LEVEL BY IMPLEMENTING TECHNOLOGY INTENSIVE PROJECTS IN PREFERENCE TO LABOR INTENSIVE PROJECTS."

Level of Agreement	Frequency	Percent
Strongly Disagree	3	3.7
Disagree	28	34.6
Somewhat Agree	31	38.3
Agree	18	22.2
Strongly Agree	1	1.2
Total	81	100

N = 81, Mean = 2.83, SD = 0.86, Mean Response = Somewhat Agree

Data presented in Table XXI are respondents' level of agreement to the statement, "Increased use of tractor tillage is necessary in developing countries to expand output level." Of those responding five (6.2%) Strongly Disagreed with the statement, twenty seven (33.7%) said they Disagreed. Somewhat Agree was the response of thirty-six (45.0%), while ten (12.5%) assigned a rating of Agree. Only two (2.5%) Strongly Agreed with this statement. Combined, the group "Somewhat Agreed" with the statement. The standard deviation for this item was found to be 0.86.

TABLE XXI

LEVEL OF AGREEMENT WITH THE STATEMENT "INCREASED USE OF TRACTOR TILLAGE IS NECESSARY IN DEVELOPING COUNTRIES TO EXPAND OUTPUT LEVEL."

Level of Agreement	Frequency	Percent
Strongly Disagree	5	6.2
Disagree	27	33.7
Somewhat Agree	36	45.0
Agree	10	12.5
Strongly Agree	2	2.5
Total	80	100

N = 80, Mean = 2.7, SD = 0.86, Mean Response = Somewhat Agree

Reported on Table XXII are respondents' level of agreement to the statement, "Microcomputer technology is indispensable in developing countries for increased crop and livestock production." Eight (9.9%) of those responding Strongly Disagreed with the statement, thirty-one (38.3%) Disagreed. Twenty-six (32.1%) said they Somewhat Agreed, while Agree was the judgment of fourteen (17.3%) of the group. Only two (2.5%) of those responding said they Strongly Agreed with this item. The group judgment for this area was "Somewhat Agree." A 0.97 standard deviation was found for this category.

TABLE XXII

LEVEL OF AGREEMENT WITH THE STATEMENT "MICROCOMPUTER TECHNOLOGY IS INDISPENSABLE IN DEVELOPING COUNTRIES FOR INCREASED CROP AND LIVESTOCK PRODUCTION

Level of Agreement	Frequency	Percent
Strongly Disagree	8	9.9
Disagree	31	38.3
Somewhat Agree	26	32.1
Agree	14	17.3
Strongly Agree	2	2.5
Total	81	100

N = 81, Mean = 2.64, SD = 0.97, Mean Response = Somewhat Agree

In Table XXIII are data regarding respondents' level of agreement to the statement "To increase output level, governments of developing countries should choose more projects that enhance input use (fertilizers, pesticides)." Strongly Disagree was the response of three (3.7%) of the group responding while another twenty-two (26.8%) Disagreed with this statement. Thirty-nine (47.6%) said they Somewhat Agreed while Agree was the response of fourteen (17.1%) of the group. The remaining four (4.9%) Strongly Agreed. The group mean response was "Somewhat Agree." A 0.88 standard deviation was calculated for this item.

TABLE XXIII

LEVEL OF AGREEMENT WITH THE STATEMENT "TO INCREASE OUTPUT LEVEL, GOVERNMENTS OF DEVELOPING COUNTRIES SHOULD CHOOSE MORE PROJECTS THAT ENHANCE INPUT USE (FERTILIZERS, PESTICIDES)."

Level of Agreement	Frequency	Percent
Strongly Disagree	3	3.7
Disagree	22	26.8
Somewhat Agree	39	47.6
Agree	14	17.1
Strongly Agree	4	4.9
Total	82	100

N = 82, Mean = 2.93, SD = 0.88, Mean Response = Somewhat Agree

Reported in Table XXIV are data regarding respondents' level of agreement to the statement, "A policy consideration for agricultural development in developing countries is to emphasize agricultural projects that provide irrigation and water distribution facilities." The judgment of three (3.8%) of those responding was Strongly Disagree while twenty (25.6%) indicated that they Disagreed with this policy. Another thirty (38.5%) of those responding found themselves in the Somewhat Agree level. Agreed was the response of twenty-three (29.5%) while the remaining two (2.6%) Strongly Agreed with

this policy. The combined group response was "Somewhat Agree." A 0.90 standard deviation was calculated for this item.

TABLE XXIV

LEVEL OF AGREEMENT WITH THE STATEMENT "A POLICY CONSIDERATION FOR AGRICULTURAL DEVELOPMENT IN DEVELOPING COUNTRIES IS TO EMPHASIZE AGRICULTURAL PROJECTS THAT PROVIDE IRRIGATION AND WATER DISTRIBUTION FACILITIES."

Level of Agreement	Frequency	Percent
Strongly Disagree	3	3.8
Disagree	20	25.6
Somewhat Agree	30	38.5
Agree	23	29.5
Strongly Agree	2	2.6
Total	78	100

N = 78, Mean = 3.02, SD = 0.90, Mean Response = Somewhat Agree

Data reported in Table XXV are respondents' level of agreement to the statement "Developing countries generally need well-trained extension personnel and facilities for better production results." Only one respondent (1.2%) of the

group who responded to this item Strongly Disagreed to the statement. Another two (2.4%) said they Disagreed while Somewhat Agree was the response of seven (8.5%) of the group. Thirty-three (40.2%) said they Agreed while Strongly Agree was the judgment of 39 (47.6%) of the group responding. The group mean response was determined to be "Agree." A 0.83 standard deviation was found for this item.

TABLE XXV

LEVEL OF AGREEMENT WITH THE STATEMENT "DEVELOPING COUNTRIES GENERALLY NEED WELL-TRAINED EXTENSION PERSONNEL AND FACILITIES FOR BETTER PRODUCTION RESULTS."

Level of Agreement	Frequency	Percent
Strongly Disagree	1	1.2
Disagree	2	2.4
Somewhat Agree	7	8.5
Agree	33	40.2
Strongly Agree	39	47.6
Total	82	100

N = 82, Mean = 4.30, SD = 0.83, Mean Response = Agree

Table XXVI are data regarding respondents' level of

agreement to the statement, "Lesser degree of mechanization is a factor responsible for the difference in output level between developed and developing nations." Of those responding only one (1.2%) Strongly Disagreed while fifteen (18.5%) Disagreed with this statement. Thirty-two (39.5%) said they Somewhat Agreed while Agree was the response of thirty (37.0%) of this group. Only three (3.7%) Strongly Agreed with this statement. As a group their combined response was found to be "Somewhat Agree." The standard deviation calculated for this area was 0.84.

TABLE XXVI

LEVEL OF AGREEMENT WITH THE STATEMENT "LESSER DEGREE OF MECHANIZATION IS RESPONSIBLE FOR THE DIFFERENCE IN OUTPUT LEVEL BETWEEN DEVELOPED AND DEVELOPING NATIONS."

Level of Agreement	Frequency	Percent
Disagree	15	18.5
Somewhat Agree	32	39.5
Agree	30	37.0
Strongly Disagree	3	3.7
Total	81	100

N = 81, Mean = 3.23, SD = 0.84, Mean Response = Somewhat Agree

The last question in this section of the instrument asked respondents to list and rate other agricultural technologies and their impacts by using the same rating scale. Because this last question received little or no response it was not analyzed like the rest.

Summary of Presentation and Analysis of Findings

This research effort has focused on perceived agricultural technology needs of developing countries with respect to the achievement of sustainability and stabilizing yield. Investment in developing countries agricultural development by MIAC institutions and the ever declining agricultural productivities of many developing countries in Africa, Asia and Latin America constitute a major problem of this research. The view of some respondents is that problems of agricultural development are not necessarily the same across the developing world. Different countries or regions in the developing world have unique problems. Some are in great need of water management expertise, some don't; some face severe problems of natural disasters such as drought, flood, etc., and some don't. Many lack a handful of well trained extension personnel, some don't and some have developed research capabilities for crop and livestock improvement while others have not. Site and region specific

solutions to problems are to be the focus of development efforts.

To answer the major objectives of this study which were: 1) To determine respondents' extent of involvement and sustained interest in agricultural technology; 2) To determine respondents perceptions with regard to the impact of selected agricultural technology on the level of crop and livestock production in many developing countries; and, 3) To determine respondents perceptions as regards the level of importance of selected agricultural technology with respect to achievement of sustainable agriculture in developing countries, respondents generally agreed that some of the agricultural technologies addressed in this survey were important toward the achievement of sustainability in developing countries. There was also some agreement regarding the impact of some agricultural technologies toward the expansion and stabilization of yield. Agreement by respondents was measured by the interpretation of calculated mean responses for all the agricultural technologies investigated, e.g., strongly agree, agree, very important, important, very interested. Respondents generally indicated continued interest in taking up future assignments in developing countries.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

This chapter presents a summary of the following topics which were addressed in the study: Purpose of the study, rationale of the study, objectives of the study, design of the study and the major findings of the study. Conclusions and recommendations presented hereafter were drawn from the abovementioned topics.

Purpose of the Study

The purpose of this study was to determine the extent of involvement in developing countries by selected U.S. agricultural professors and their perceptions of the current and projected needs regarding agricultural technology.

Rationale of the Study

In the past and even at the current time, Mid-America International Agricultural Consortium (MIAC) institutions as well as other university consortia and world organizations have designed and assisted in implementation of agricultural projects to enhance advancement of the agricultural

infrastructures in developing countries. These efforts have yielded far-reaching results in many countries, but some projects did not achieve observable effects. This survey was an attempt to determine information which could be helpful in promoting appropriate agricultural technology as a means of achievement of sustainability and yield stabilization in developing countries.

Objectives of the Study

To accomplish the purpose of this study, the following specific objectives were established.

1. To determine respondents' extent of involvement and sustained interest in agricultural technology development in developing countries.
2. To determine respondents' perceptions with regard to the impact of selected agricultural technology on level of crop and livestock production in many developing countries.
3. To determine respondents' perceptions as regards the level of importance of selected agricultural technology with respect to achievement of sustainable agriculture in developing countries.

Design and Conduct of the Study

The following procedural steps were accomplished after

the researcher had reviewed several studies and literature related to this study.

1. Determine population of this study.
2. Developed the instrument for collecting data.
3. Determine procedure for collecting data.
4. Determined appropriate method for presentation of findings and data analysis.

The population of this study consisted of agricultural faculty from Mid-America International Agriculture Consortium (MIAC) institutions who have had involvement in agricultural development in a developing country within the past five years. A questionnaire was mailed directly to each of the respondents thus identified from the five institutions that comprise MIAC. Initial mailing of questionnaires was in the first week of October 1993. By the last week of November, a total of 76 (66%) out of the total 116 questionnaires mailed were returned. A follow-up letter was mailed in the first week of December and this effort increased the response rate to 71.5% by the cut-off date of December 20, 1993.

The data analysis procedure chosen consisted of descriptive statistics including the calculation of frequency distributions, percentages, means and standard deviations. Statistical analysis assistance was provided to the researcher by the OSU Statistics Department utilizing the Statistical Analysis System (SAS) computer program. Mean responses were utilized as appropriate basis for interpretation of findings.

To further facilitate interpretation of calculated mean response, range of real limit values were established for each response category. For example, mean responses ranging from 3.6 to 4.3 could be interpreted as very important, or very interested or very involved. See details of this process on page 34. Likert-type scales were used to elicit responses. A five point Likert-type scale was utilized and values assigned to each for the various areas investigated are described on page 33.

Major Findings of the Study

The major findings of this study were grouped into four broad categories as follows:

1. Demographic data of respondents.
2. Extent of involvement, interest and nature of assignment in a developing country.
3. Perceptions as regards the level of importance of selected agricultural technology with respect to the achievement of sustainable agriculture in developing countries.
4. Perceptions of the impact of selected agricultural technology on level of crop and livestock production in developing countries.

Selected Demographic Characteristics of Respondents

Table XXVII was designed to summarize selected demographical characteristics of the 83 respondents of the study. Of this total, 79 completed questionnaires

TABLE XXVII
SUMMARY OF SELECTED DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

Characteristic	Distribution	
	N	%
Response Pattern:		
Questionnaire Mailed	116	100
Questionnaire Returned	83	71.5
Non-Respondents	33	28.4
Respondents by Sex:		
Male	79	95.18
Female	4	4.82
Total	83	100
Respondents by Institution:		
KSU	6	7.41
ISU	27	33.33
OSU	28	34.57
NU	10	12.35
MU	9	11.11
Other	1	1.2
Total	81	100
Respondents by Academic Rank:		
Assistant Prof.	3	3.61
Associate Prof.	11	13.25
Full Prof.	64	77.11
Other	5	6.02
Total	83	100

TABLE XXVII (Continued)

Characteristic		Distribution
Respondents by Project Category:		
Livestock Project	13	16.05
Soil/Agronomic Project	16	19.75
Extension/Teacher Training	10	12.35
Fishery/Water/Univ. Projects	2	2.47
Other Projects	40	49.38
Total	81	100
Respondents by Yes/No to Having Experience in a Developing Country:		
Yes	80	97.56
No	2	44.44
Total	82	100

(95.18%) were male and the remaining 4.82% were female. Another characteristic of respondents reported in Table XXVIII is the number of respondents per institution. Twenty-eight (34.5%) of the respondents surveyed were from Oklahoma State University, Stillwater, Oklahoma; twenty-seven (33.33%) were from Iowa State University, Ames, Iowa; ten (12.35%) were from the University of Nebraska, Lincoln, Nebraska; nine (11.11%) were from the University of Missouri, Columbia, Missouri; six (7.41%) were from Kansas State University and three did not identify their institution. Full professors accounted for 77.1% of total respondents; 13.3% were associate professors;

3.6% were assistant professors, while the remaining 6.0% were of other ranks.

Respondents identified a total of 38 countries as sites where they had their most recent agricultural development experience. As shown in Table I, Morocco was named by nine respondents as the country of their most recent agricultural development assignment, thus making Morocco the modal country. Kenya was next as the most commonly named country. It was named by seven respondents as the country of their most recent agricultural development assignment in a developing country (see Table I).

Respondents' most recent agricultural development experience in a developing country fell into one of the following project categories and proportions: Soil and agronomic projects, sixteen (19.8%), livestock, thirteen

TABLE XXVIII

SUMMARY OF RESPONDENTS LEVEL OF INTEREST IN MOST RECENT AND POSSIBLE FUTURE ASSIGNMENTS IN DEVELOPING COUNTRIES

Response Category	Mean Response	SD	Interpretation Of Mean Response
Quality of Experience in Most Recent Assignment	4.49	0.61	Very Interesting
Level of Interest in Future Agricultural Assignments	4.08	0.95	Very Interested

(16.0%), extension/teacher training, ten (12.3%), fisheries/ water development/university establishment, two (2.5%) and projects other than the four categories above, forty (49.4%).

Extent of Involvement, Interest and Nature of Assignment:

Table XXVIII is a summary table depicting respondents' rating of the quality of experience in their recent travel to a developing country. the table shows that the combined rating of respondents' experience in a developing country was "Very Interesting."

Included in the summary Table XXVIII was the combined judgment of respondents as regards their level of interest in taking up future agricultural assignments in developing countries. This was found to be at the level of 4.08, indicating they were "Very Interested," or very positive for future assignments.

Table XXIX represents a summary as regards the extent to which respondents were involved in selected activities in their most recent assignment in a developing country. As indicated by the 3.90 mean response, it was determined that in their most recent out-of-country experience, respondents had been "Very Involved" in research/development activities. On the average they were "Involved" in the social and cultural aspects of their host countries as determined by the 3.37 mean response calculated for this comparison factor.

The extent to which respondents most recent assignment in

a developing country involved activities other than teaching or research and development or extension was determined to be 3.09 or "Involved."

The group felt that in their most recent assignment they had been "Involved" in teaching activities. The mean response to this item was 3.08. The combined judgment of respondents regarding the extent to which their most recent assignment in a developing country involved extension was determined to be 2.77 or "Involved."

In the Summary Table XXIX it was determined that respondents level of involvement in the social and cultural aspects of their host country fell into the classification of "Involved." Included in Table XXIX is the combined judgment of respondents as regards the extent to which their most recent assignment in a developing country involved teaching. This was found to fall into the level of "Involved."

The combined rating of respondents as regards the extent to which their most recent assignment in a developing country involved research and development is also depicted in Table XXIX. This was determined to be "Very Involved."

TABLE XXIX

SUMMARY OF RESPONDENTS EXTENT OF INVOLVEMENT IN AGRICULTURAL TECHNOLOGY DEVELOPMENT IN DEVELOPING COUNTRIES

Response Category	Mean Response	SD	Interpretation Of Mean Response
Extent to Which Most Recent Assignment Involved Research and Development	3.90	1.35	Very Involved
Level of Involvement in Social and Cul- Cultural Aspects of Host Country	3.37	0.99	Involved
Extent to Which Most Recent Project Involved Activities Other than Teaching or Research and Development or Extension	3.09	1.99	Involved
Extent to Which Most Recent Assignment Involved Teaching	3.08	1.57	Involved
Extent to Which Most Recent Assignment Involved Extension	2.77	1.35	Involved

TABLE XXX

SUMMARY OF PERCEPTIONS AS REGARDS THE LEVEL OF IMPORTANCE OF SELECTED AGRICULTURAL TECHNOLOGY WITH RESPECT TO THE ACHIEVEMENT OF SUSTAINABLE AGRICULTURE IN DEVELOPING COUNTRIES

Response Category	Mean Response	SD	Interpretation Of Mean Response
Degree of Importance of Disease Resistant Varieties of Crops and Livestock to the Achievement of Sustainable Agriculture in Developing Countries.	4.11	0.83	Very Important
Degree of Importance of Use of Better Storage Facilities to the Achievement of Sustainable Agriculture in Developing Countries.	3.9	0.92	Very Important
Degree of Importance of High Yielding Varieties of Crops and Livestock to the Achievement of Sustainable Agriculture in Developing Countries.	3.85	0.85	Very Important
Degree of Importance of Erosion Technology to the Achievement of Sustainable Agriculture in Developing Countries.	3.85	1.09	Very Important
Degree of Importance of Wind Erosion Technology to Achievement of Sustainable Agriculture in Developing Countries.	3.63	1.05	Very Important

TABLE XXX (Continued)

Response Category	Mean Response	SD	Interpretation Of Mean Response
Degree of Importance of Sprinkler Irrigation and Efficient Water Management to Achievement of Sustainable Agriculture in Developing Countries.	3.14	0.99	Important
Degree of Importance of Improved Planting, Tillage and Harvesting Equipment to Achievement of Sustainable Agriculture in Developing Countries.	3.4	0.83	Important
Degree of Importance of Agri-Chemicals (Pesticides, Fungicides, and Herbicides) to Achievement of Sustainable Agriculture in Developping Countries.	2.85	0.76	Important
Degree of Importance of Replacing Animal Powered with Engine Powered Farm Equipment to Achievement of Sustainable Agriculture in Developing Countries.	2.83	0.83	Important

Table XXX is a summary of the level of importance respondents assigned to selected technologies for the attainment of sustainable agriculture in developing countries. Respondents "Agreed" that better infrastructure (roads,

bridges, electricity) can be a limiting factor toward yield expansion and stabilization. Mean response was found to be 4.13.

It was found that with respect to disease resistant varieties of crops and livestock for the achievement of sustainable agriculture in developing countries, respondents considered this to be "Very Important," with a 4.11 mean response.

Better storage facilities as were rated by respondents as "Very Important," with a mean response of 3.90.

Respondents' perception as regards the importance of high yielding varieties of crops and livestock in developing countries was found to fall in the level of "Very Important," calculated mean response was 3.85.

Respondents perceived technological innovations to control soil erosion from runoff of heavy rainstorms as "Very Important" to the achievement of sustainable agriculture in developing countries. Mean response for this item was found to be 3.63.

The degree of importance of a new technology to control wind erosion with respect to the achievement of sustainable agriculture in developing countries was by the judgment of respondents found to be "Very Important." The mean response for this item was found to be 3.63.

Respondents' judgment with respect to the degree of importance of improved planting, tillage and harvesting

equipment was found to fall in the level of "Important" with a mean response of 3.40.

Sprinkler irrigation equipment and efficient water management for achievement of sustainable agriculture in developing countries were rated at "Important" by the respondents. The mean response was found to be 3.14.

Respondents assigned a rating of "Important" with respect to replacing animal powered with engine powered farm equipment to achieve sustainability in developing countries. This item had a mean response of 2.85.

Degree of importance of agri-chemicals (pesticides, fungicides and herbicides) to the achievement of sustainability in developing countries received a rating of "Important" by those responding. Mean response calculated for this item was 2.85.

Table XXXI is a summary of level of agreement by respondents to the impact of selected technologies and government policies on level of output in developing countries.

With a mean response of 2.64 respondents "Somewhat Agreed" that microcomputer technology is indispensable in developing countries for increased crop and livestock production.

TABLE XXX

SUMMARY OF PERCEPTIONS OF THE IMPACT OF SELECTED AGRICULTURAL TECHNOLOGY ON LEVEL OF CROP AND LIVESTOCK PRODUCTION IN DEVELOPING COUNTRIES

Response Category	Mean Response	SD	Interpretation Of Mean Response
Level of Agreement To The Statement "Developing Countries Generally Need Well-trained Extension Personnel and Facilities for Better Production Results."	4.30	0.83	Agree
Level of Agreement to the Statement "The Present Level of Agricultural Production in Many Developing Countries Can Be Expanded Through Better Infrastructure.	4.13	0.73	Agree
Level of Agreement With the Statement "Lesser Degree of Mechanization is Responsible for the Difference in Output Level Between Developed and Developing Nations."	3.23	0.84	Somewhat Agree
Level of Agreement With the Statement "A Policy Consideration for Agricultural Development in Developing Countries is to Emphasize Agricultural Projects that Provide Irrigation and Water Distribution Facilities."	3.02	0.90	Somewhat Agree

TABLE XXXI (Continued)

Response Category	Mean Response	SD	Interpretation Of Mean Response
Level of Agreement With the Statement "To Increase Output Level, Governments of Developing Countries Should Choose More Projects that Enhance Input Use (Fertilizers, Pesticides)."	2.93	0.88	Somewhat Agree
Level of Agreement With the Statement "Governments of Developing Countries Can Increase Output Level by Implementing Technology Intensive Projects in Preference to Labor Intensive Projects."	2.83	0.86	Somewhat Agree
Level of Agreement With the Statement "Increased Use of Tractor Tillage is Necessary in Developing Countries to Expand Output Level."	2.7	0.86	Somewhat Agree
Level of Agreement With the Statement "Microcomputer Technology is Indispensable in Developing Countries for Increased Crop and Livestock Production."	2.64	0.96	Somewhat Agree

"Agreed" was the judgment of respondents as regards their level of agreement to the statement "developing countries generally need well-trained extension personnel and facilities for better production results." A mean response of 4.30 was found for this response category.

Also found was that respondents "Somewhat Agreed" that lesser degree of mechanization is a factor responsible for the difference in output level between developed and developing countries. The mean response calculated for this response was 3.23.

"Somewhat Agreed" was the rating assigned by respondents regarding the statement "A policy consideration for developing countries should be to emphasize agricultural projects that provide irrigation and water distribution facilities." Mean response for this item was 3.02.

It was determined that respondents "Somewhat Agreed" that governments of developing countries should choose more projects that enhance input use (fertilizers and pesticides) as a means of expanding output level. Calculated mean response was 2.93.

It was determined that respondents "Somewhat Agreed" that governments of developing countries can increase output level by implementing technology intensive projects in preference to labor intensive projects. A mean response of 2.83 was calculated for this item.

Respondents "Somewhat Agreed" that increased use of

tractor tillage can expand output level in developing countries with a mean response of 2.7.

Conclusions

Based upon analysis of the data supplied by MIAC faculty who had participated in agricultural development activities in developing countries and who responded to this study, it was concluded that:

1. In terms of certain demographic characteristics, these were well-established professionals, most of whom had advanced to the rank of Full Professor and who had prior experience in developing countries. As a group they were almost exclusively male. They represented a wide range of areas of expertise, with no specialization with more than two-thirds of the respondents being from Oklahoma State University and Iowa State University.
2. These faculty had been rather extensively involved in a broad range of projects prior to the time of the study, with no patterns of specialization in the types of projects in which they had taken part. However, the group had been involved to the greatest extent in research/development oriented activities. They also were accorded many opportunities to become familiar with social and cultural aspects of the host countries. Extension-related activities received the least amount of attention.

3. Involvement in MIAC projects were assessed as quite satisfying experiences by the faculty members and they had positive feelings about the prospects of taking up future ventures of this type.
4. Development of a cadre of well-trained extension personnel, providing appropriate facilities and a better infrastructure for agriculture are accomplishments which will result in greater amounts of advancement in crop and livestock production in developing countries than will the application of more technologies per se.
5. Technologies associated with enhancing yields of crops and livestock through improved varieties, improved storage of what is produced and control of soil erosion are viewed as those which offer the greatest potential for achievement of sustainability in agricultural production in developing countries. Considered of lesser importance but still having considerable potential would be irrigation and water management, mechanization and chemicals.
6. It must be recognized that in addition to the application of technology, achievement of sustainability is dependent upon a number of other factors such as climatic conditions, financial services, effective markets and stable political systems within the developing countries.
7. A large number of agricultural projects in developing countries have been successful because of being staffed

by dedicated, well-qualified individuals who are affiliated with MIAC institutions. Because of this, MIAC faculty have had a positive impact upon international agricultural development and there is even more potential for the future.

Recommendations

The following recommendations presented here are based on the conclusions of this study.

1. For most developing countries, agricultural technology development should fit the economic constraints and cultural heritage of that country or region.
2. Increased government support or the development of an efficient prizing and marketing of agricultural products is recommended for most developing countries.
3. There should be increased support from governments for research and extension, this support should be demonstrated by increased budget spending for research and extension and salary improvement for agriculture workers.
4. Commitment to policy-decisions favorable to agricultural development and efficient management programs are highly recommended to most developing countries.
5. Development of a strong national seed program with private sector involvement is necessary to reach as many farmers as possible with improved cultivars. Generally

developing countries need to develop research capabilities instead of consultants.

6. For most developing countries institution building with respect to financial service/credit institutions and market institutions in addition to a stable political system should be the focus of development efforts.
7. Increased but judicial use of machinery, fertilizers, pesticides, microcomputers and other technologies can help increase production, but culture and other offsetting disadvantages should be strongly considered.
8. For most countries where sufficient food is produced but much is lost between the producer and consumer, increased use and development of post-harvest processing and preservation technology is recommended but culture and economic constraints should be considered.
9. For most developing countries agricultural technology is not the limiting factor but more emphasis on proper management.

Recommendations for Additional Research

These recommendations for additional research are based on the findings of the study.

1. Research of this nature to determine the management needs for a given crop or livestock production in a given region or country is highly recommended.

2. A similar research to determine technology needs for a given crop or livestock development for a given region or country is also recommended.
3. A similar study to determine the transferability of a given agricultural technology from a given region of the world to another region is also recommended.
4. Research should be conducted to determine the usefulness of an imported agricultural technology to the producers in the region or country where that technology is extensively used.
5. A separate study to determine the level of local and government support needed by Mid-America International Agriculture Consortium (MIAC) institutions by their host countries for better results in their projects is recommended.

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APPENDICES

OKLAHOMA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD
FOR HUMAN SUBJECTS RESEARCH

Date: 07-15-93 **IRB#:** AG-93-028

Proposal Title: SELECTED AGRICULTURE PROFESSORS INVOLVEMENT AND PERCEPTIONS OF AGRICULTURAL TECHNOLOGY IN DEVELOPING COUNTRIES

Principal Investigator(s): Dr. H. Robert Terry, Francis Eloi

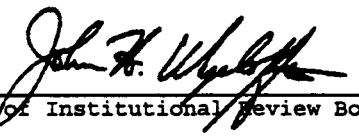
Reviewed and Processed as: Exempt

Approval Status Recommended by Reviewer(s): Approved

APPROVAL STATUS SUBJECT TO REVIEW BY FULL INSTITUTIONAL REVIE BOARD AT NEXT MEETING.
APPROVAL STATUS PERIOD VALID FOR ONE CALENDAR YEAR AFTER WHIC CONTINUATION OR RENEWAL REQUEST IS REQUIRED TO BE SUBMITTED F BOARD APPROVAL. ANY MODIFICATIONS TO APPROVED PROJECT MUST A BE SUBMITTED FOR APPROVAL.

Comments, Modifications/Conditions for Approval or Reasons fo Deferral or Disapproval are as follows:

Modifications received and approved.

Signature:  Date: July 16, 1993

Chair of Institutional Review Board

Oklahoma State University

DEPARTMENT OF AGRICULTURAL EDUCATION
DIVISION OF AGRICULTURE

STILLWATER, OKLAHOMA 74078-0
448 AGRICULTURAL HALL
405-744-5129
FAX: 405-744-9693

P. O. Box 283
Stillwater OK 74076
July 14, 1993

Dear OSU Agriculture Department Head:

During the past few decades, member institutions of the Mid America Agricultural Consortium (MIAC) have been involved i international agricultural programs in developing countries A wide range of faculty members have had very active roles in these and similar efforts.

We are conducting a study to determine the level of involvement by selected agricultural faculty and their perceptions of developing countries' agricultural technology. We are asking that you please provide us a listing of your faculty who have had any type of experience with an agricultural development project in a developing country within the past five years. Your list can be returned in the enclosed self-addressed envelope.

Thank you in advance for your cooperation.

Sincerely,

Robert Terry
Head, Ag Education

Arthur Klatt
Director, International Programs

Francis Elo
Graduate Researcher

Oklahoma State University

DEPARTMENT OF AGRICULTURAL EDUCATION
DIVISION OF AGRICULTURE

STILLWATER, OKLAHOMA 74078-04
448 AGRICULTURAL HALL
405-744-5129
FAX: 405-744-9693

September 1, 1993

Dear Educator:

We are in the process of conducting a research study, purpose of which is to determine the extent of previous involve of selected professors in developing countries. Also to determined are perceptions of the current and projected need these countries regarding agricultural technology. We have ch to survey faculty members of Mid-America International Agricult Consortium (MIAC) institutions who have had experiences agricultural development in a developing country.

Because you have been identified as one who has had this of experience, we are asking for your cooperation and assistanc this effort. Please complete the enclosed questionnaire and re it in the stamped, self-addressed envelope provided. As researchers, we will be the only ones to have access to responses. Your name or your responses will not be identi individually. We are only interested in aggregate data. It hoped that the conclusions drawn from the study can provide hel insights for decision-making and achieving sustainable agricul in many developing countries.

If you have questions concerning the questionnaire or aspect of the study, you may contact either of us at the add shown above. Also, you can contact the OSU Institutional Re Board, located in 001 Life Sciences East on the OSU campus. telephone number there is 405-744-9991.

Thank you in advance for your cooperation.

Sincerely,

Dr. H. Robert Terry, Head
Agricultural Education

Francis Eloi
Graduate Student
Agricultural Educatio

Involvement and Perception of Developing Countries Agricultural Technology by Selected Agricultural Professors

Section I: Personal Information

Please answer each question by writing your response in the space provided or marking an X where there are brackets.

1. Sex

   [ ] Male
   [ ] Female

2. Name of employer (Institution)_____

3. Please indicate your academic rank

   _____ Full professor
   _____ Associate professor
   _____ Assistant professor
   _____ Other (specify) _____

4. What is your area of expertise, e.g., Agronomist, Agricultural Economist _____

5. Indicate whether you have had any experience in agricultural development projects in a developing country.

   ( ) Yes ( ) No

6. Name the country of your most recent agricultural development activity in a developing country _____
   _____

Section II: This section is designed to determine your involvement, interest and nature of assignment in a developing country agricultural development.

1. Considering your most recent assignment in a developing country, how would you rate your experience?

   5) Extremely interesting
   4) Very interesting
   3) Interesting
   2) Uninteresting
   1) Extremely uninteresting.

2. Indicate your level of interest in taking up future agricultural development assignment in a developing country?

   5) Extremely interested
   4) Very interested
   3) Interested
   2) Somewhat interested
   1) Not at all interested.

3. How would you rate your degree of involvement in the social and cultural aspects of your host country?

   5) Extremely involved
   4) Very involved
   3) Involved
   2) Somewhat involved
   1) Not at all involved.

4. Indicate number of times you have been involved in agricultural development projects in a developing country (a one time involvement will range from even one day assignment to two or more years assignment in a given project).

   Number of times involved_____

5. Indicate to what extent your most recent assignment in a developing country involved teaching, research/development, and extension (can be involved in more than one).

	Extremely Involved	Very Involved	Involved	Somewhat Involved	Not at All Involved
Teaching					
Research/Development					
Extension					
Other (Please Specify)					

6. Into which of these project categories does your most recent agricultural assignment fit?

   a) Livestock development project
   b) Soil/agronomic project
   c) Irrigation/water development project
   d) Establishment of a university
   e) Fishery development project
   f) Extension/Teacher training project
   g) Other (Specify)_____.

Section III: The following items seek to determine your perceptions as to the importance of selected agricultural technology toward the achievement of sustainable agriculture in developing countries. Please respond to each of the following statements on a five-point scale, EI indicates Extremely Important; VI - Very Important; I - Important; U - Unimportant; EU - Extremely Unimportant.

	Level of Importance				
	EI	VI	I	U	EU
1. The development of disease resistant varieties of crops and livestock.	☐	☐	☐	☐	☐
2. Development of high yielding varieties of crops and livestock.	☐	☐	☐	☐	☐
3. Increased utilization of sprinkler irrigation equipment and efficient water management programs.	☐	☐	☐	☐	☐
4. Improved planting, tillage and harvesting equipment.	☐	☐	☐	☐	☐
5. Replacement of animal powered with engine powered farm equipment.	☐	☐	☐	☐	☐
6. Increased use of agri-chemicals (pesticides, fungicides and herbicides).	☐	☐	☐	☐	☐
7. Introduction of new technology consistent with reducing soil loss from wind erosion.	☐	☐	☐	☐	☐
8. Technological innovations to control soil erosion from runoff of heavy rainstorms.	☐	☐	☐	☐	☐
9. Development and use of better storage facilities for drying seeds and grains.	☐	☐	☐	☐	☐

10. Other technologies (please describe and rate).

☐ ☐ ☐ ☐ ☐

Section IV: This section of the instrument will help determine your perception of the impact of selected agricultural technology on output level in developing countries. Please respond to each of the following statements using a five-point scale, SA - indicates strongly agree, A - indicates agree, SWA - indicates somewhat agree, D - indicates disagree, SD - strongly disagree.

	Level of Agreement				
	SA	A	SWA	D	SD
1. The present level of agricultural production in many developing countries can be expanded through better infrastructure (roads, bridges, electricity).	☐	☐	☐	☐	☐
2. Governments of developing countries can increase output level by implementing technology intensive projects in preference to labor intensive projects.	☐	☐	☐	☐	☐
3. Increased use of tractor tillage is necessary in developing countries to expand output level.	☐	☐	☐	☐	☐
4. Microcomputer technology is indispensable in developing countries for increased crop and livestock production.	☐	☐	☐	☐	☐
5. To increase output level, governments of developing countries should choose more projects that enhance input use (fertilizers, pesticides).	☐	☐	☐	☐	☐
6. A policy consideration for agricultural development in developing countries is to emphasize agricultural projects that provide irrigation and water distribution facilities.	☐	☐	☐	☐	☐
7. Developing countries generally need well-trained extension personnel and facilities for better production results.	☐	☐	☐	☐	☐
8. Lesser degree of mechanization is a factor responsible for the difference in output level between developed and developing nations.	☐	☐	☐	☐	☐
9. Other impacts (please describe and rate).	☐	☐	☐	☐	☐

Please note any comments you might have regarding your professional involvements in development projects in developing countries.

_____

_____

_____

_____

_____

Thank you in advance for your anticipated cooperation.
Please return questionnaire in the enclosed stamped envelope to:

Francis Eloi
P.O. Box 283
Stillwater, OK 74076

Oklahoma State University

COLLEGE OF AGRICULTURAL SCIENCES AND NATURAL RESOURCES

Department of Agricultu
448 Agricultural Hall
Stillwater, Oklahoma 74(
405-744-5129, FAX 405-

November 23, 1993

Dear Educator:

This serves as a follow-up to the letter mailed to you on Septe 30, 1993 in which we enclosed a survey instrument for a rese study. The purpose of the research effort is to determine extent of your previous involvement in agricultural developmen developing countries and your perceptions of the current projected needs of these countries regarding agricult technology. The population of our survey is faculty member Mid-America International Agricultural Consortium (M institutions who have experience in agricultural development developing country and you were identified as one of t individuals.

We would very much like to have your inputs to this effort. order to do so we have once again attached a copy of the instru for your response. We recognize you have a pretty busy sched but your response is vital to the success of this survey, w completion deadline is December 20, 1993. If you have questions concerning the questionnaire or any aspect of the st contact either of us at the address shown above.

Thank you in advance for your cooperation.

Sincerely,

Dr. H. Robert Terry, Head
Agricultural Education

Francis Eloi, Graduate Student
Agricultural Education

VITA 2

Francis Isu Eloi

Candidate for the Degree of

Doctor of Education

Thesis: SELECTED U.S. AGRICULTURAL PROFESSORS' INVOLVEMENT WITH AND PERCEPTIONS OF AGRICULTURAL TECHNOLOGY IN DEVELOPING COUNTRIES

Major Field: Agricultural Education

Biographical:

Personal Data: Born in Afikpo, Abia State of Nigeria March 12, 1954, the son of Alu and Mary Oyiri Eloi.

Education: Graduated from county secondary school Abakaliki in Anambra State, Nigeria, in May 1973 and Macgregor College, Afikpo in Imo State of Nigeria, June 1975. Received associate of science degree from Yakima Valley College, Yakima Washington, December, 1979. Received Bachelor of Science degree from Oklahoma State University with major in Animal Science May, 1985. Received the Master of Science degree with a major in Agricultural Education from Oklahoma State University December, 1990. Completed requirements for the Doctor of Education degree at Oklahoma State University in May, 1994.

Professional Experience: High school science instructor with the Imo State School System of Nigeria 1980-1981. Yakima Valley College Art Gallery employee 1978-1979. Employee of the Oklahoma State University's Physical Plant Services 1981-1985.

Goals: It is my desire to work in an organization where I can contribute my experience and education.