AN IMPLEMENTATION MODEL FOR AGRICULTURAL INNOVATIONS

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AN IMPLEMENTATION MODEL
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CHAPTER 1

INTRODUCTION

All agricultural advisers are development planners. Every planner should understand not only his phase of the work, but how it relates to each of the other phases of implementing an agricultural innovation. Advisers who understand the complete process of implementation can offer considerable assistance to their host country colleagues and help avoid many pitfalls in the future.

This paper is written to present an over-view of a coordinated implementation process for agricultural innovations. The implementation of an agricultural innovation is a dynamic and complex process. A model is used in an attempt to present this complex process in a clear and concise manner. This is a macro-approach to the study of the linkages and channels of information flowing throughout the implementation process.

No attempt has been made to touch on all aspects of this complex process. It is hoped that the reader will gain further insight into the implementation process and the paper will stimulate further innovative thought on the subject. Many of the ideas expressed in this paper are an outgrowth of the author's 14 years overseas

as an agricultural extension adviser for the U.S. Agency for International Development.

At the close of the Second World War, the idea of foreign aid as a part of the United States foreign policy was established under the Marshall Plan. This gave birth to the philosophy that a peaceful world is one where all nations share in the enjoyment of the fruits of development. The Marshall Plan was principally one of economic aid to the war-devastated countries of Europe. Technical knowledge was not in short supply in Europe. It was not until the United States began to assist some of the less-developed countries that technical assistance was included in the foreign aid.

The establishment of the "Point Four" program gave emphasis to the value of technical assistance. "Point Four", under President Truman, was designed to transfer technical knowledge to the less-developed countries of the world in an effort to accelerate development. Most of the countries in the underdeveloped part of the world were primarily agricultural. Therefore, the major thrust in technical assistance was the transfer of agricultural innovations.

To facilitate the utilization of the agricultural innovations, much of the effort was spent in general education, health and institution building. Agricultural technicians experimented with application of American

agricultural innovations to the less-developed countries with very little large-scale success. The technological spread in agriculture between the United States and the less-developed countries was just too great for large-scale adoption of U.S. innovations.

It was soon learned that drastic methodological alterations must be made before these innovations would be useful in the less-advantaged parts of the world. A concerted effort was made by the U.S. agricultural technicians overseas, during the days of the International Cooperation Administration, to make the necessary alterations in U.S. agricultural innovations for utilization in aid-receiving countries. This effort culminated in the dramatic breakthrough now called the "Green Revolution."

As a result of the "Green Revolution," the world-wide development focus is now placed on agriculture. Development priorities in the less-developed countries have shifted almost exclusively to agriculture and industry related to agriculture. The threat of an impending population explosion was beginning to have real meaning until the breakthrough in wheat and rice production in Asia took place. The world heaved a sigh of relief and the feeling of despair changed to hope for the future. Many feel, however, that this breakthrough will only allow us to take a quick breath before the population problem hits us with its full explosion.

The technological breakthrough causing the dramatic change in production was the discovery of new fertilizer responsive varieties of wheat and rice. Farmer response to these new innovations was so rapid it caught the world be surprise. The implications of the "Green Revolution" were not appreciated until recently. The prevailing question now is whether the "Green Revolution" is causing more problems than it solves. Wharton (20, P. 476) in the article "Cornucopia or Pandora's Box?" states it this way: "The quiet, passive peasant is already aware of the modern world-far more than we realize- and he is impatient to gain his share."

Thus far in the "Green Revolution" there have been many signs of incomplete implementation planning. The emphasis appears to have been concentrated on the supply of agricultural inputs and encouraging the farmer to grow the new wheat and rice. Evidently little concern was shown for the consequences of over-production or emphasizing the average farmer's involvement. The marketing problem, consumer preference, transportation availability, continuing research, institutional inadequacies and credit availability have emerged as "second generation" problems.

Many of these problems exist today because the development planners, both foreign and host country nationals, did not visualize the complete implementation picture.

Evidently much of the planning was done one section at a time without proper cross-communication.

CHAPTER 2

PRESENTATION OF THE IMPLEMENTATION MODEL

Over-view of the Implementation Process

Many people consider the implementation of an agricultural innovation as merely convincing the farmer to adopt the innovation. The implementation process is far more involved and complex a process. To gain a clear perspective of the complete process, one must start at the source of the innovation (research) and follow the complete process through to the consumer of the agricultural product.

The complete implementation process can be broken down into seven major phases. The sequential order of implementation of these phases is: (1) source, normally through research; (2) policy formulation, both the planning and the supervision; (3) inputs used for the innovation; (4) communicators, both professional and volunteer change agents working with the farmer; (5) the adoption phase, use of the innovation; (6) marketing, all the ramifications of purchasing the product, distribution and handling; and (7) disposition of the commodity to the ultimate consumer.

In actual practice, the implementation of an agricultural innovation does not always follow this exact sequence

of phases but instead jumps back and forth between phases a great deal. For purpose of analysis, however, we will consider the implementation process in its most common sequence as outlined above.

An over-all understanding of the complete implementation process will help an American agricultural adviser to gain a better perspective of his job assignment. He will see more clearly the interrelationships between his job responsibilities and that of his American colleagues. He can also help his host country colleagues to appreciate the importance of their role in the implementation process.

Other Studies

Most studies relating to adoption of agricultural innovations are either studies of the adoption process at a micro level (the individual farmer) or studies related to agricultural development in general. There appears to be a definite void in studies relating themselves directly to the implementation process for agricultural innovations. It seems inconsistent that the vehicle that is the driving force behind general agricultural development has received so little attention. Many authors deal with segments of the implementation process but few, if any, deal with entirety. One possible reason for this situation may be the high degree of specialization present in our higher-education system.

Dr. A.T. Mosher, in his book, Getting Agriculture Moving, (8, Pp. 63 & 123) has identified five "essentials" and five "accelerators" which he considers universal for agricultural development. The five essentials are (1) markets for farm products, (2) constantly changing technology, (3) local availability for supplies and equipment, (4) production incentives for farmers, and (5) transportation. These essentials all are of equal importance in that they are all interrelated and any one can be crucial for any given situation. Given the five essentials, the five accelerators (while not absolutely required) that will speed agricultural development are (1) education for development, (2) production credit, (3) group action by farmers, (4) improving and expanding agricultural land, and (5) national planning.

Dr. Mosher's approach is one for general agricultural development, but the reader will note the similarity between the essentials and accelerators and the phases listed for the implementation process. The only notable difference lies in the degree of importance attributed to some of the accelerators listed. When considering implementation of an innovation, national planning and production credit are both important accelerators while the other three accelerators listed would be considered "givens."

Insight into the manipulation of economic variables and the recognition of the peasant farmer as a victim of

economic suppression has helped in conceptualizing the implementation model. Dr. T.W. Schultz, University of Chicago, (16) believes that the crucial feature in traditional agriculture is the low rate of return to investment in agricultural factors. To transform this type of agriculture, Schultz believes a more profitable set of factors must be developed and supplied (which is a matter of investment - investment in both human and material capital). He also points out (16, Pp. 130-44) that the real factors of production are concealed under "technological change" and that the analysis of the vital factors causing change has been passed over repeatedly because of the general treatment of the economic factor "technological change."

The coordination required in agricultural development planning is emphasized by Mellor (7, P. 379). He states, "The purpose of planning for development is to achieve greater efficiency through coordination. Effective coordination is based on an over-all view of the development process." With regard to planning, Gunnar Myrdal (9, P. 726-34) speaks not only of the forces exerted from abroad for development planning, but also of the counterforces at work. Social and political counterforces often prevent an otherwise excellent plan from being implemented. The activity of the counterforce is usually an outgrowth of misinformation or opposition to the group supporting the plan.

Lester R. Brown, in his excellent book on the "Green Revolution" called Seeds of Change (2, P. 77), has very effectively described the need for understanding the entire implementation process through his description of the multitude of "second generation" problems evolving from the rapid increases in rice and wheat production. The Pearson Report (10, P. 61) also refers to the array of new problems emerging as a result of the "Green Revolution."

Dr. Clifton Wharton, Jr. in his "Strategies for Rural Development" (19, Pp. 1 and 2) states this proposition: "In the early stages of agricultural development many aspects of agricultural production and distribution cannot be centrally planned or directed. Some centralized actions are effective, but most are not." He continues: "Agricultural development programs must be based upon an analysis of the developmental process in its complex totality concentrating upon key factors, each of which must be studied in all the uniqueness of each particular situation."

This paper is an attempt to do what Dr. Wharton suggests in his last statement, drawing together information from the studies cited above plus several others and the author's past experiences.

Development of the Basic Model

The implementation process for an agricultural innovation has been described as a complex and dynamic process. In order to analyze implementation, we will freeze the process and look at each of the components individually and collectively to gain a better insight as to its functions. First, we shall look at the linkages and information channels forming the constellation around each phase of the basic model. Then we will join the phases, unfreeze the model and observe it in action.

Source or research phase. The identity of the source or research phase includes (1) international research concerning the innovation, (2) governmental research conducted at a national level, (3) research conducted at research stations in the various regions of the country, (4) local research conducted by farmers in cooperation with or independent of regional research stations, and (5) private research conducted by private industry in connection with their agricultural product. In the formulation of an agricultural innovation, the government research people at the national level gather research information from all other research sources and evaluate the findings.

Within the research phase a constellation of linkages and information channels is established from the national research to all other research institutions. In

addition, a second constellation of linkages is established by national research to each of the other implementation phases to expedite the research function required by each of the other phases. Details of these functions will be found in Chapter Three. For a clearer picture of the research phase and its double constellation of linkages please refer to the paradigm in Figure 1.

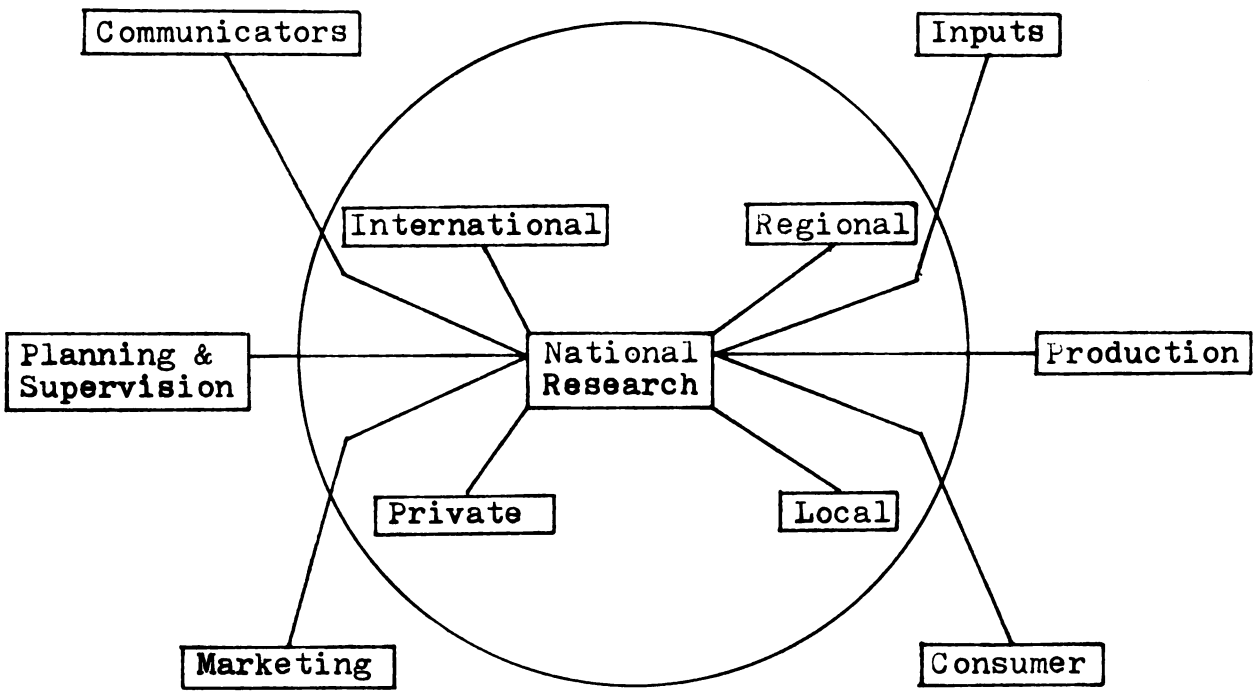

Figure 1. Research Linkages Within and Outside of Research

Policy formulation. Planning and supervision are both included in the policy formulation phase. The development planning for implementation of the agricultural innovation is primarily one of collection and evaluation of information and plans submitted from other phases of the model. Evaluation then continues with an economic analysis of the innovation and a feasibility study. Planners then study the consequences of implementation and the incentives for adoption, followed by preparation of the plan and its institutionalization. Planners, officials of the several ministries involved and agricultural educators function as supervisory personnel. Further explanation of development planning and supervision will be found in Chapter Four.

The linkages and flow of information to the planners are vital to the successful implementation of an innovation. At all times throughout the implementation process, the plan should be under revision. This requires the continuation of the linkages and flow of static-free information throughout the life of the implementation process. Please refer to the paradigm in Figure 2 for a picture of these linkages.

Supply of Input Materials. The materials used as inputs for this phase of the model are those used in crop production; however, the model can easily be adapted to livestock, poultry or horticultural innovations with only

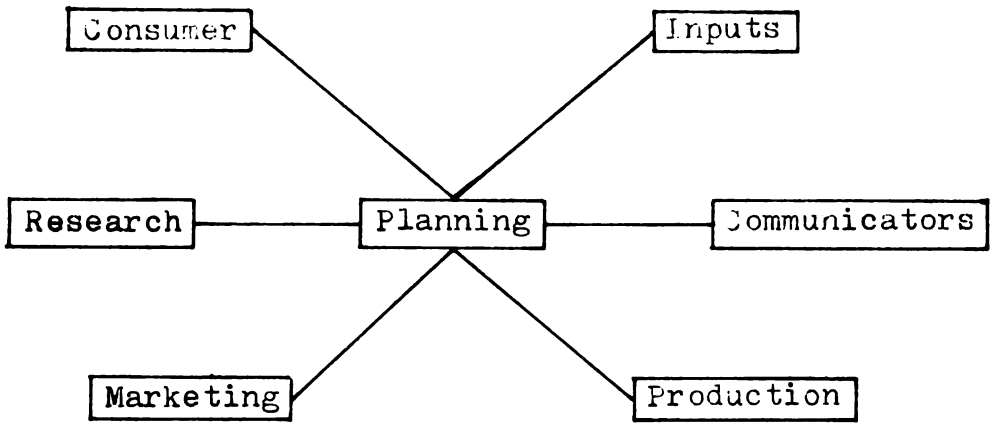

Figure 2. Planning Linkages

the appropriate input substitutions. Included in the input phase are the seeds, fertilizer, insecticides, and machinery as the input materials. In addition, the transportation, distribution, sales and credit for the inputs are also a part of the input phase. Further explanation of the input functions will be found in Chapter Five.

Determination of information regarding types and quality, predicted quantity, location of selling points,

incentives for manufacturing and credit availability for the desired inputs makes the establishment of linkages with other phases of the model mandatory. Input institutions are mostly in the private sector and often linkages between the private sector and government are difficult to establish. This does not reduce their necessity, however. These linkages and static-free information channels, as shown in Figure 3, should be established in all phases of the model except the consumer.

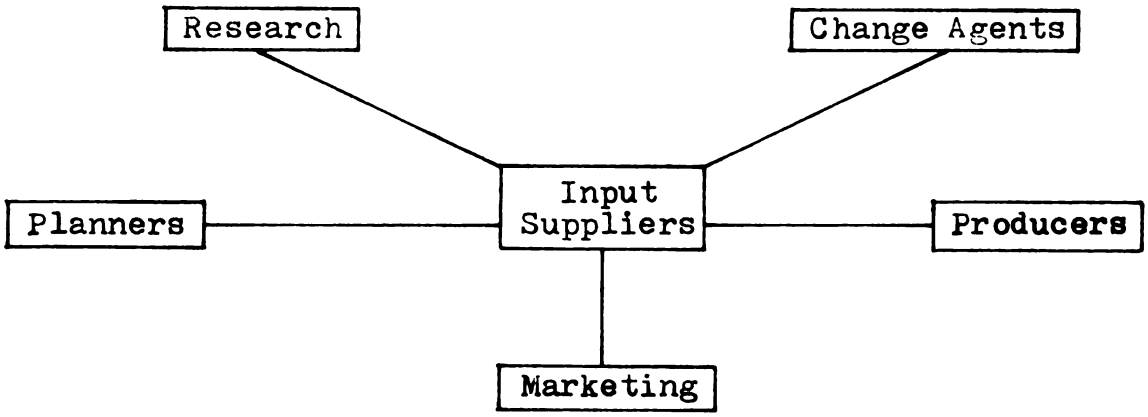

Figure 3. Linkages of Input Suppliers

Change Agents. Both formal change agents and volunteer communicators are included in this phase of implementation. Formal change agents are professionals such as extension workers, school teachers, and politicians. The volunteer communicators are such people as community

leaders, trader, migrant laborers and herdsmen, truck and bus drivers and absentee family members. The effect of cultural patterns on the adoption of innovations is also handled in the change agent phase of the model. The above change agents and their functions in implementing an innovation are explained in Chapter Six.

By far the strongest linkage of the change agents is with their clientele - the farmer. However, linkages with all other phases of the model are required in order to give advice to the farmer in the most satisfactory manner. The change agents must have excellent communication channels, for he is often the only unbiased source of information regarding the innovation for the farmer. To conceptualize the change agent linkages, please refer to Figure 4.

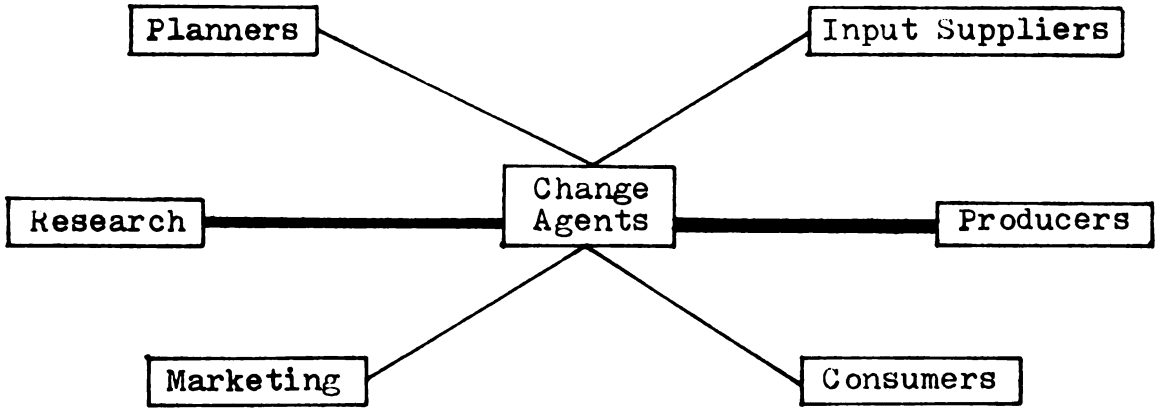

Figure 4. Change Agent Linkages

The Production Phase. The farm family with their resources is the production unit. The actual production of the crop, using the new innovation, is the major objective of the entire process. In addition to the farm family, the production phase includes the land situation, the prevailing level of knowledge, the influence of incentives for adoption, social pressures on the adopters, the difficulty of the methodology, the investment requirements and the adoption process. A detailed description of the production phase will be found in Chapter Seven.

The linkages of the producers form two constellations; one of those who have frequent contact with the producer, and the other, those who have only occasional contact. The inner constellation includes the change agents, the input suppliers and the marketing people. The outer constellation is comprised of the remaining phases of the model. Please refer to Figure 5 for a picture of the two constellations in the production phase.

The Marketing Phase. The general area of marketing is one of the most frequently neglected phases of the model. Traditional marketing systems can seldom handle the large volume of product resulting from the innovation. The marketing phase includes both the purchasing and the distribution of the product. In the purchasing function, the buying system, the quality control standards and the price fixing systems are included. The distribution function

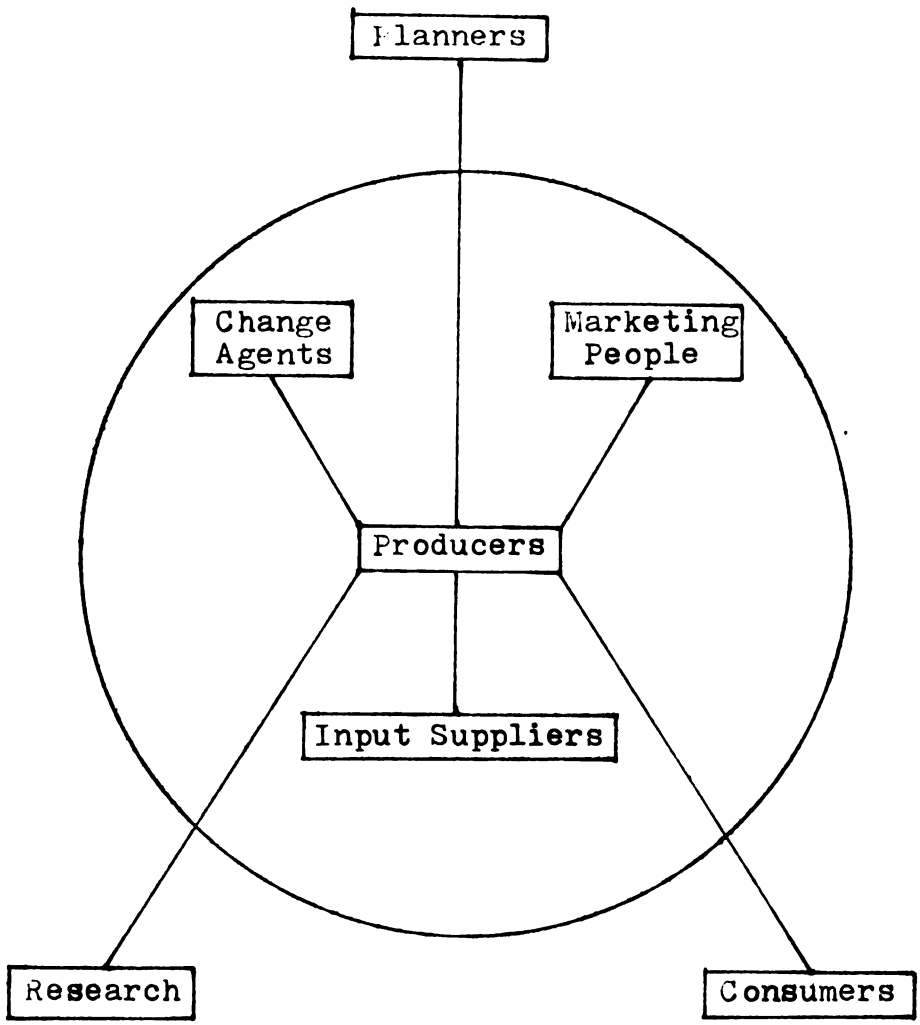

Figure 5. Linkages of the Production Phase

includes transportation, storage, handling and processing. Details on these marketing functions will be found in Chapter Eight.

The marketing phase is the bridge between the producer and the consumer and strong linkages are established between

them. Linkages with the other four phases of the model are weaker and form the outer constellation. Figure 6 shows these relative relationships.

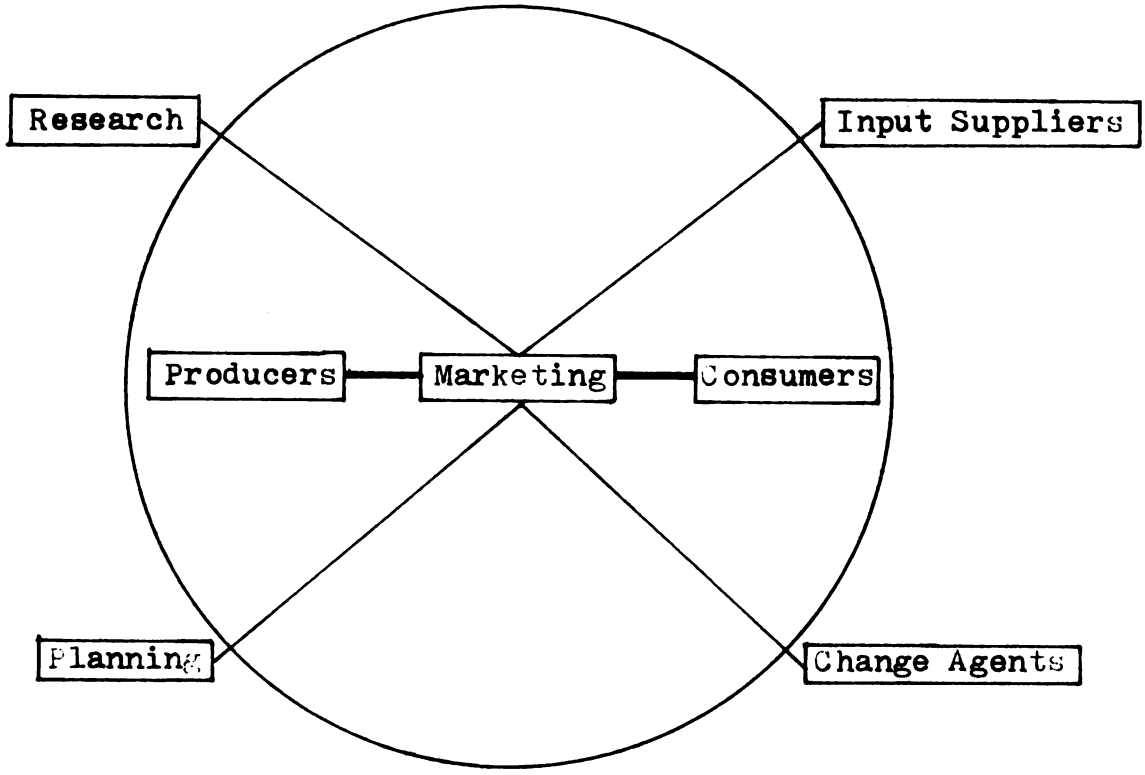

Figure 6. Marketing Linkages

Disposition of the Commodity. The consumption of the product produced with the innovation is critical to the entire process. Reluctance by the consumer to accept the product will cause the entire process to grind to a

halt. The majority of the food crop produced will be consumed locally. Surplus to local needs will be moved to regional and national population centers and their surplus will be exported from the country. If the product is an export crop it will either be moved from the producer to the processor or directly exported abroad. Details on the disposition of the product will be found in Chapter Nine.

The linkage between marketing and the consumer is very strong. In the case of the food production the producer and consumer are, for a large portion of the product, one and the same. Marketing and the producer form the inner consumer constellation, while a less intense linkage consisting of the researchers, planners and change agents form the outer constellation. Figure 7 illustrates this.

Forming the Basic Model. We have looked at each of the component phases and their respective constellations. Now we can assemble the basic model for the initial implementation of the innovation. For clarity and application of the model, the introduction of a new fertilizer-responsive wheat variety will be used as the example.

Research has developed and tested a new variety of fertilizer-responsive wheat and delivered this information to the planners. Upon receipt of this information, the planners immediately evaluated the information and found it to be suitable for implementation. A coordinated plan is drafted as a composite of plans submitted from the input

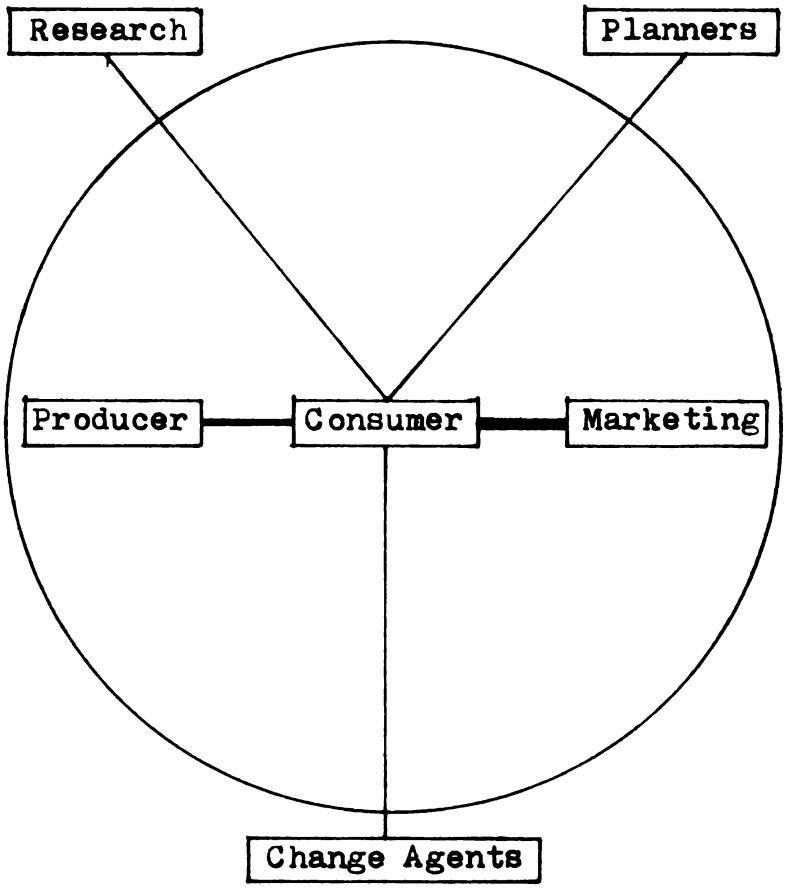

Figure 7. Consumer Linkages

suppliers, professional change agents, producers, marketing people and consumers. The draft of the master plan is passed to the input suppliers and change agents for implementation of the wheat innovation.

The input suppliers evaluate the draft plan and prepare for the manufacture, distribution and sale of the necessary inputs to the farmer. The change agents, after receiving training, embark on a campaign to educate the

farmer on the new wheat innovation. Change agents receive seed and fertilizer from the input suppliers to carry on a field demonstration program with the farmer.

The farmer, after learning about the new wheat innovation, decides to purchase seed and fertilizer. He produces a much larger crop of wheat than before and sells his surplus to the local market. The marketing people evaluate the quality of the wheat, determine the selling price to the consumer and pay the farmer accordingly. The wheat is transported to the consumer in the heavily populated area and offered for sale. The consumer, after inspecting the quality and determining the price he will pay, purchases the wheat and takes it home for his family use.

The reader will note that at each step of the implementation process a message is transmitted over the information channel. The receiver of the message evaluates the information and acts accordingly. To conceptualize the basic implementation model, please refer to Figure 8.

The Implementation Model In Action. The basic model as described above is very idealistic. For clarity of presentation we assumed that each evaluation in the entire implementation process had a positive reaction to the message received through the information channel. In real life even the most successful implementation of innovations does not operate this smoothly. Communication of messages seldom conveys the information in such a clear

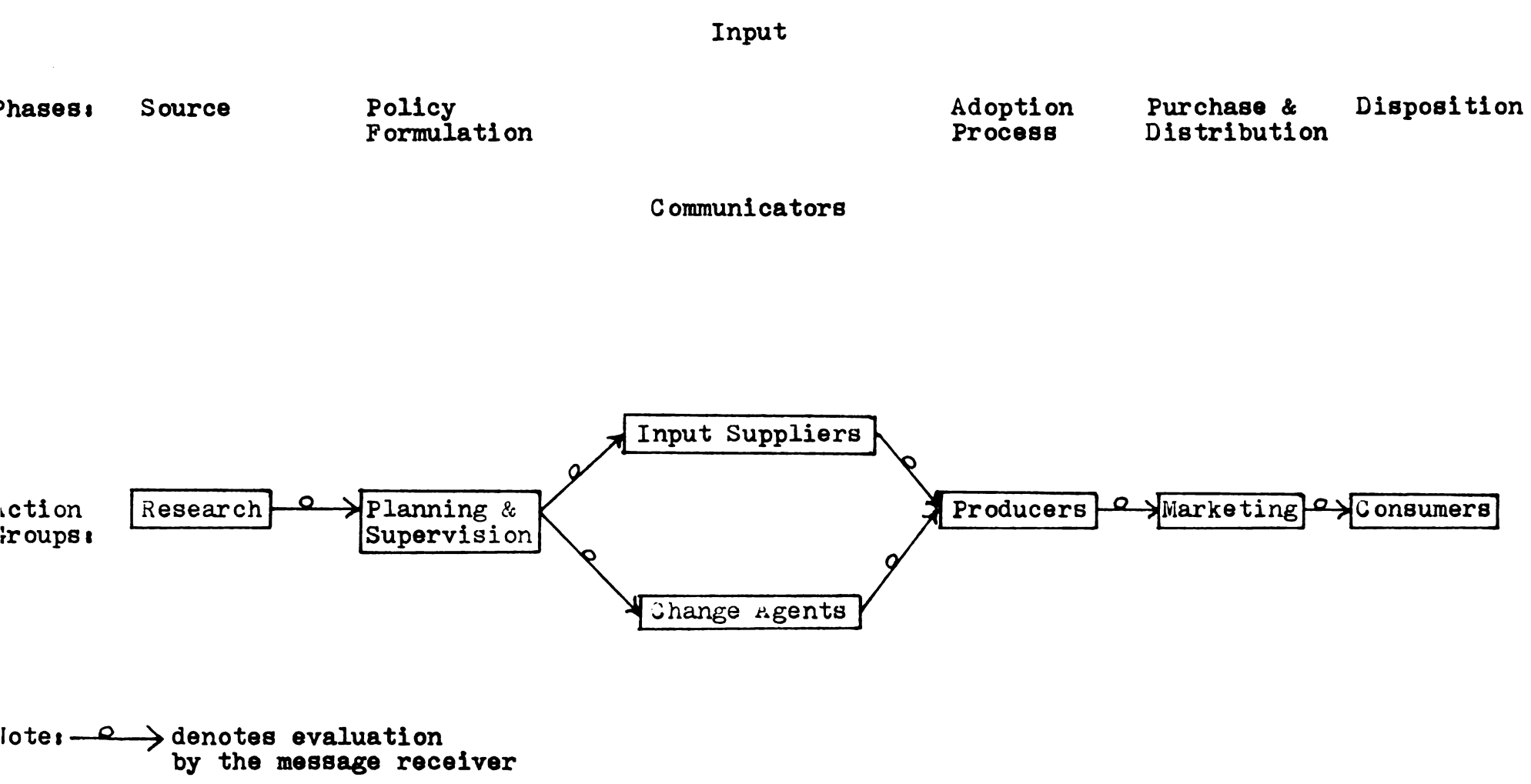

Figure 8. Basic Implementation Model for Agricultural Innovations

manner that there is no misunderstanding. The implementation process is not one of stratified categories where, upon completion of one phase, the full responsibility is shifted to the next. As noted in Figures 1 to 7, each phase has its constellation of linkages that covers almost the entire implementation spectrum.

A more realistic approach to the implementation process is where the phases and sub-phases interact with each other. When a production problem with the farmer develops, the message goes out to all phases of the process notifying each phase of the problem and expecting each phase to take appropriate action. The real problem arises when the channel of communication breaks down or has excessive static so that the message is badly garbled or never transmitted. Maintenance of smooth flowing, static-free information channels between all phases of the implementation model is mandatory for successful implementation of agricultural innovations.

Let's look at the implementation process in action and see how it performs when problems emerge. We will continue to use the example of the new fertilizer-responsive wheat variety but this time the farmers in one locality, after using it for three years, discover that the new variety is badly infested with rust.

The farmers report the rust problem to their local extension worker who passes the message through his channels

to the ministry headquarters. Ministry officials immediately take steps to determine if the rust problem is localized or wide-spread. They find that the rust is present on 80 percent of the wheat in the country and calculate that the harvest will be reduced by about 30 percent from the anticipated amount. This startling information is sent from the ministry to people in all phases of the implementation process and the top government officials. The government takes steps to import wheat in an attempt to cover the anticipated loss in yield.

Research is notified by the policy formulators to find a rust resistant variety of wheat that responds to fertilizer and yields as much as the old variety. Input suppliers are notified that the expected need for fertilizer will probably be less for the next planting season. Change agents are requested to make weekly reports on wheat harvest expectations. Farmers are requested to make every effort to save as much wheat in the harvesting operation as possible and are assured that a rust resistant variety will be distributed in the near future. Marketing people are notified of a reduction in expected harvest and that they will be handling a large quantity of imported wheat. Consumers are asked to use their present supply of wheat sparingly.

All these messages are fed simultaneously into the information channel and evaluated upon receipt. If the information channel is open and static-free, immediate

positive action can be taken. If not, the busy information channel will be overloaded with reverse directional messages that will cause considerable delay in taking appropriate action.

To look at the brighter side, let us suppose that research has found a suitable, rust resistant wheat variety and the government is importing a sufficient quantity to supply each wheat farmer with a small amount. Immediately upon this announcement, all phases of the implementation process are notified to be prepared for reversing their direction and "tool up" for appropriate action.

The reader can now understand how complex and dynamic is the implementation process for agricultural innovations. For visual comprehension of this dynamic process, please refer to the "action model" in Figure 9.

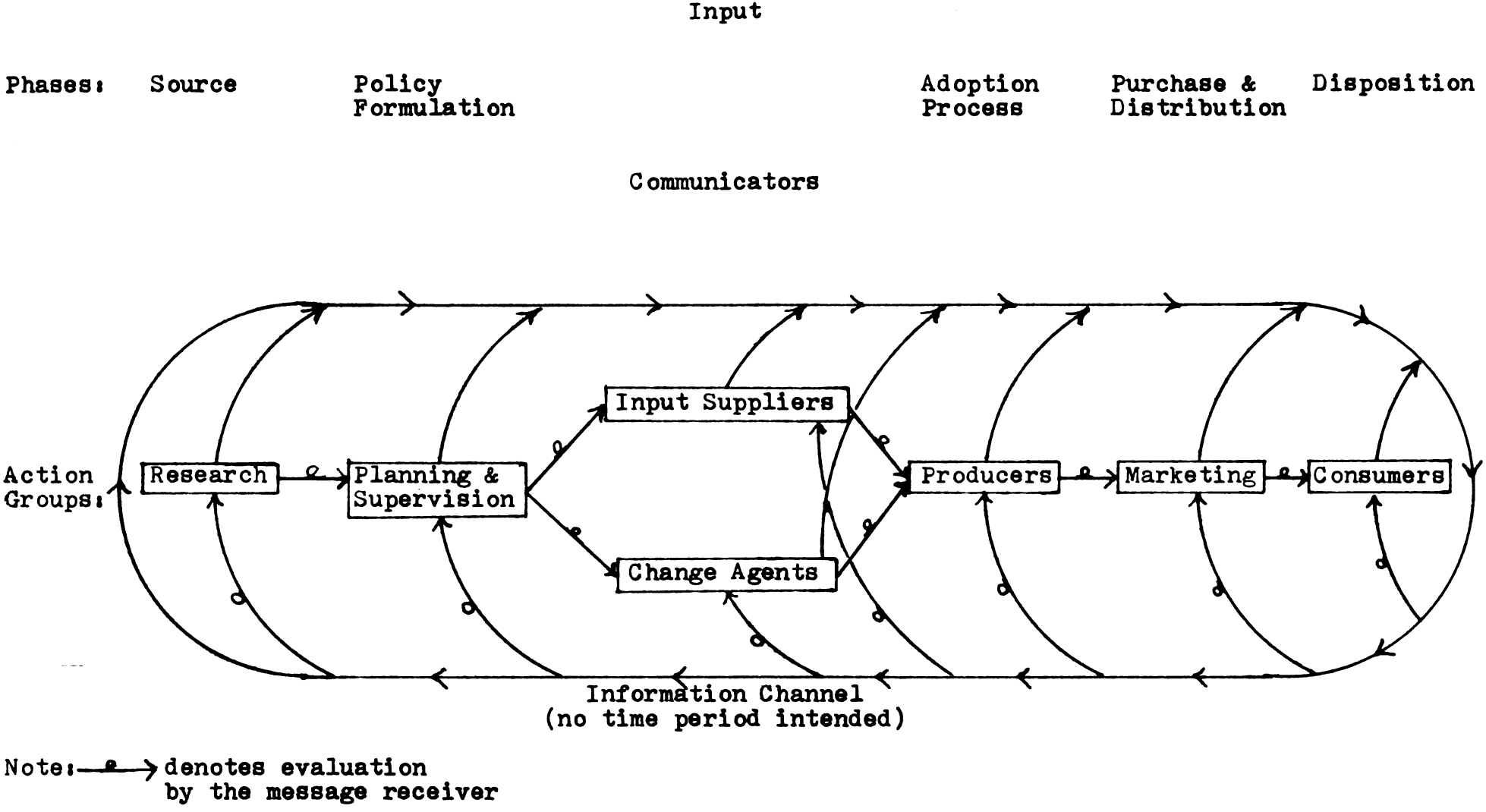

Figure 9. An Implementation Model for Agricultural Innovations

CHAPTER 3

RESEARCH

The term "research" used in the implementation model refers to all forms considered research and experimentation. For the purpose of this model, research is considered the source of all innovations. In this sense it can be the major contributor to the innovation or, as in the case of the new varieties of wheat and rice, merely an evaluative function with prediction of adaptibility.

Research is traditionally divided into basic and applied research. Most of the less-developed countries (LDCs) in the world would do well to rely upon basic research emanating from the more-developed countries. Basic research usually applies to all parts of the world and similar results would be only repetitious and expensive. Most LDCs are in short supply of experienced research people, and those they have should concentrate on applied research. The utilization and proper interpretation of basic research requires well-trained and experienced researchers in each of the less-developed countries. These research people must look upon basic research from the standpoint of its application to their home country.

Internationally Applicable Research

The recent breakthrough, now titled, "The Green Revolution", (a result of the efforts of the Rockefeller and Ford Foundation people in Mexico and the Philippines) is an excellent example of the utilization of internationally applicable research by many LDCs throughout Asia. As a result of these successes in rice and wheat varieties, a number of international research stations are being established. It would behoove each LDC to establish very close liaison with each and every international research station dealing with research applicable to their country. These international research stations are excellent sources for obtaining new varieties by the thousands, a germ plasm bank, and in some cases breeding stock banks. As a result of the "Green Revolution", the door has been opened wider than ever for the exchange of varietal research material. It is expected that this exchange will greatly increase in the future.

Another ever growing source of international technological and research findings is what Lester R. Brown (2, P. 55) calls Multi-national Agri-business Corporations. These corporations, mostly based in the United States, are aggressively establishing their enterprises in an ever increasing number of LDCs. While they are naturally interested in earning profit for their stockholders, these corporations are spreading technical knowledge and research findings concerning fertilizer, insecticides, farm

machinery, management, construction, etc., that is otherwise unavailable in many LDCs. These modern international corporations must be regarded as an important source of research information.

Available international research is not limited to crop production. When preparing for the implementation of an agricultural innovation concerning crop production, it would be well for the LDC to also aggressively seek international research information concerning input production, marketing, transportation, sociology, administration, institutionalization, processing, packaging, consumer preferences, etc. When looking into the future requirements for research availability in LDCs, it would be well to consider the establishment of a full-time organization devoted solely to the collection of international research. This would include all types of research previously mentioned, plus any other that would be deemed important to the implementation of agricultural innovations. This organization should be operated as a knowledge bank similar to the one presently in the U.S. Department of Agriculture. If possible it should be computerized for quick and efficient extraction of pertinent information.

Governmental Research

Governmental and nationally based research has several responsibilities. It should act as the collection point for

all pertinent research having both direct and indirect concern with agriculture. It is necessary to place the very best research men available at the national level so that proper interpretation and evaluation can be made. The national research organization must at all times keep every channel open to all research sources. This would include international, regional, local and private research sources.

After the interpretation and evaluation of all available research, the national research organization is then responsible for directing the in-country governmental research and co-ordinating the various research efforts country-wide. This would also include the recognition of and close liaison with multi-national agri-business corporations within the country.

The national research program in its planning and organization should concentrate its entire effort in the area of applied research. In some cases, verification of basic research may be necessary. If applicable basic research is not available it may be necessary to conduct some original research in a specific area. Applied research, in order to be meaningful to the farmers in the country, must be geared to the economic, social, and cultural characteristics of the average farmer. Research personnel at the national level should be required to make frequent trips to the farming areas of the country to gather

first-hand knowledge of existing farm conditions. In addition, national research personnel should also be encouraged to make trips to international research stations and national research stations in adjoining countries to establish personal contact with fellow researchers concerning specific areas of research.

As the new agricultural innovation is adopted, it causes what is termed "second generation" problems. These problems are the outgrowth of the rapidly increasing production caused by large scale establishment of the new innovation. National research personnel should be aware of and anticipate these second generation problems well in advance of their occurrence. Research personnel should not limit the research to crop and livestock production only. The research should include related areas such as marketing of the commodity, production and utilization of input items, irrigation water available, the peasant farmer situation, effective production incentives, social pressures concerning production, effective communication methods with farmers, processing, packaging, and transportation of the commodity and consumer preferences for the commodity. Immediately following the discovery and positive evaluation of a new agricultural innovation, related research problems should be identified and solutions sought in anticipation of the future need.

Economic research in connection with the new innovation is also necessary. A cost-benefit analysis followed by a feasibility study should be connected with any new innovation. Predetermined results are vital to the sustained utilization of the new innovation.

Regional Research

Very few countries of the world have uniform topography, climate, soil and rainfall. Certain areas or regions of each country are designated as the wheat area, the grazing area, the dry land area, the irrigated area, the fruit area, etc. This has caused research stations to be established in the several regions specializing in suitable crops and livestock for that particular area. These regional research stations function primarily for the benefit of the local region. Because a wheat area may have some fruit growers and irrigated areas may also have some crops grown under dry land conditions, regions must share research findings. Provincially oriented regional research personnel, however, often neglect sharing their findings with other regions and the national research organization.

An innovation or variety determined to be a good possibility by national researchers is passed to the regional station for adaptability and comparative testing. Local innovations and varieties are compared with new introductions.

Applied research at the regional level is a vital step in the research process. This is the most important test for an innovation: finding out conclusively if its adaptability suits conditions of the area. Replicated trials should be made to validate findings for the area. Success or failure in implementation of the innovation depends upon the degree of certainty in research findings at the regional research station.

Local Research

One of the best measurements of validity for research findings from the regional level is to conduct a series of farmer test plots at the local level. These plots are the final step in research relating to a given innovation. Up to this point all research has been done on government farms under optimum conditions. The farmer test plot is designed to ascertain how the innovation will react under typical farming conditions. A successful series of farmer test plots can help determine the successful application of the innovation by farmers.

Local research can be viewed from yet another direction. Each farming community has, over the years, developed various methods of production peculiar to that community. Some of these approaches to production are ingenious when one considers the limited input available and adaptation of local materials and knowledge to scientific agriculture.

Truly great discoveries are sometimes made by local farmers. These unique innovations are often discovered by farmers by accident or through an endless series of trial and error attempts. Nevertheless, these innovations should be sought out by the regional research men and studied. Often the knowledge gained from this type of local research can open doors to solutions of a series of yet unsolved problems.

Private Research

The term private research in this sense refers to research conducted by other than government sponsorship. Private individuals with training in technical agriculture and companies or corporations supplying agricultural inputs carry out research of their own. In most cases private research is less conservative than government research. The high degree of constraints in budget, personnel, material and operating procedures are not usually present in private research. One should recognize that government has little control over private research, and its findings may often be questionable and biased.

Freedom to pursue unorthodox lines of experimentation often produces a major breakthrough and a new a approach to a problem. National and regional research personnel should contact fellow researchers in the private sector, exchange ideas and offer support on common problems. This helps all parties concerned and keeps everyone abreast of new developments in a specific area of research.

Communicating Research Findings

Research publications are usually of a very technical nature and often not understood by development planners and change agents who rely on research information to carry out their responsibilities. Most research people hesitate to rewrite their research findings into a form for laymen to understand. They prefer to write for research publications. Research articles are mainly written for other researchers in their particular field of work. In many countries there is a possessive attitude toward research findings, and the information is available only upon specific request. Communicating research findings to people outside of research circles is a common problem throughout the world.

A possible solution to this problem would be the establishment of an Extension/Research Liaison Unit in the national research institute. This writer was instrumental in the establishment of the Extension/Research Liaison Unit in the Institute for Agricultural Research, Ahmadu Bello University, Samaru, Nigeria. This liaison unit is staffed by the Ministry of Agriculture to establish the bridge between institute research people and the extension staff who in turn pass the new information and innovations on to the farmers.

The liaison unit has two major departments: (1 subject matter specialists who are officed with researchers in a given discipline, and (2 an information section that uses

the research information furnished by the specialists to produce bulletins, leaflets, posters, flip charts, slides and training aids for use by extension agents in the field. All activities of the liaison unit are coordinated by a unit chief and two deputies. The unit functions as a two-way bridge disseminating research information to the farmer via the extension agent and presenting farmers' problems from the extension agent to research men in the institute. In addition, the liaison unit directs the activities of 23 audio/visual mobile units working in the villages of the Northern States of Nigeria.

The liaison unit has enhanced the quality and quantity of applied research accepted by farmers. Institute research workers were at first reluctant to cooperate with the liaison unit, but they have since gained considerable satisfaction through the observation of the successful adoption by farmers of recommendations resulting from their research findings. Using current and past research information, the liaison unit, with the cooperation of institute researchers, has produced in a five-year period complete sets of recommended practices on 16 major crops grown in Northern Nigeria. Carl K. Eicher (4, P. 37) points out the pioneering work in this area as a possible avenue leading to the solution to this problem.

Functional Model for Research

So far in chapter three we have been looking at research internally in its several geographical levels. Let us now look at the linkages between research and the other implementation factors described in the model. Applied agricultural research institutes could be considered service organizations serving the needs of agriculture and related areas. To carry out this service function, linkages and information channels must be established in all directions. Two-way communication channels are vital to the success of any applied research institution.

The basis of all research is the desire for increased production of an agricultural commodity. Constant linkages directly to the production sector are of first priority. This is a two-way channel of information. As pointed out earlier, the final step in research is the farmer testing of the innovation in ascertaining the adaptability under normal farming conditions. This linkage does not stop here. Continual feedback must be maintained to recognize those problems implementation has that were not initially discovered. Continuing production research will assure constant refinement of the innovation.

Before presentation of the new agricultural innovation to the development planners, research must undertake initial studies in the other sectors presented in the original model: supply sector concerning the best available inputs;

change agents' approach to sociological, psychological and cultural aspects of the innovation; marketing systems analysis and predictions for increased quantity of the commodity; consumer acceptance of the new agricultural product. These research studies should be initiated in anticipation of questions from the development planners concerning these "second generation" problems.

The innovation is then presented to development planners and implementation is planned and executed. Initial training of change agents is the responsibility of research. Transfer of accurate technical knowledge from the researchers to the change agents is a vital link in the implementation chain. Feedback from the several above named sectors concerning problems encountered during implementation is of utmost importance to research. This is the critical stage of implementation, and research people must exert every effort to keep open the two-way channel of information. They must deal expeditiously with all problems encountered and feed recommendations to the appropriate sectors as quickly as possible. Many of these problems will be presented to research via the change agents, but research people must not rely solely on this source. Direct information channels must be maintained to all sectors.

CHAPTER 4

POLICY FORMULATION - AGRICULTURE DEVELOPMENT PLANNING AND SUPERVISION

Development planning in agriculture takes place at all levels. At the international level development planning takes place in such institutions as the World Bank, Ford and Rockefeller Foundations, Asia Foundation, foreign aid programs of donor countries and the United Nations. National agriculture planning is most often related in LDCs as a portion of the five-year development plan. Too often agriculture development planning in an LDC stops at the national level. As we will discuss later, to stop at this level often renders a good agriculture development plan ineffective. Regional and local planning should be considered the core of the planning process. National planning is basically an assimilation of regional and local development plans.

The basic purpose of agriculture development planning is the acceleration and increased efficiency made possible through coordination. This coordination is based upon an over-all view of the entire developmental process. According to Mellor (7, P. 379), a development plan involves three areas: 1) governmental direct allocation and control of resources; 2) private resources controlled and directed by

government; 3) private resources guided by government through the use of incentives and market manipulations.

Only a very limited amount of the total agricultural resources can be made available for implementation of a single innovation without causing a considerable reduction in resource availability in other production areas. The major problem in correctly allocating limited resources is the difficulty in determining the rate of response to the innovation.

A specific set of objectives for the implementation of a given agricultural innovation must be formulated as a beginning step in development planning. The policy formulated is an outgrowth of these specific objectives. Positive contributions to the growth and development of a country are possible only if planning accelerates and makes development more efficient. This comparison can be made with that development which would take place naturally.

In Chapter Three, we emphasized the necessity for adequate and proven information from researchers as a vital ingredient for development. Planning relies solely upon the information available to the planners. Some of this information is gained through the past experiences of planners themselves, but the majority is that information passed to the planners from research. If the information available is incorrect or inadequate, planning may give poorer or at least no better results than if there were no

planning at all. Development planners should explore all possible sources of information considered relevant to the implementation of the agricultural innovation in question. They then must evaluate information they have collected to determine whether this innovation warrants implementation and, if so, to what extent.

A rule of thumb regarding response is for the new innovation to produce an easily observed increase in production of at least 35 percent. (11, P. 7) Where agricultural implementation efforts have a long history of failures this minimum should be raised to 50 or in some cases 100 percent increase in production. The farmer should not be expected to change his methods drastically from those of the past in order to achieve the expected level of increased production. Also, a high cash investment will greatly limit the number of farmers who can enjoy the added profits from a new innovation.

The planning process is often misunderstood. We often think of planning taking place only in the headquarters planning office. However, this office merely acts as a coordinator, and the actual planning takes place elsewhere. In order to identify the actual planners of an innovation, an example of the implementation of an agronomic innovation may be of assistance.

When research people discover a new crop variety, they select the optimum set of companion inputs to arrive at the

most favorable level of production. They present a plan of production to the planning organization including the new variety, input requirements, necessary cultural practices and the expected yield from this combination. The planning organization studies the research production plan and evaluates its implementation possibilities.

The planning organization then determines the amount of input supplies needed and requests the supply institutions to submit their plans to meet these requirements. Change agents are requested by the planning organization to submit their plan of implementation that is a result of preliminary pilot approaches to farmers. These preliminary efforts should reflect farmer response to incentives, methodology, investment and social pressures concerning the innovation.

The marketing people are requested to submit a plan for marketing the increased volume of the crop including quality control, price fixing, transportation, storage and processing. Consumer acceptance of the new variety should be tested to alleviate any later problems. Consumption of the crop at local, regional and national levels should be studied. Possibilities for export should also be evaluated for the future.

When the planning organization receives these several proposed plans, they are finally in a position for a re-evaluation of implementation possibilities. Only after

this re-evaluation can the final decision for implementation be made.

Economic Analysis of the Innovation

The planning organization is now in a position to conduct a comprehensive economic analysis. All factors of implementation should be analyzed independently and then collectively. This monumental task can be allocated to various institutions capable of such an economic analysis. These might include universities, economic institutes, large supply corporations and credit institutions. The responsibility for the composite economic analysis should rest on the staff of the planning organization.

Feasibility Study of the Proposal

The responsibility of the planning organization does not stop with the composite economic analysis of the implementation proposal. The planners must also recognize non-economic factors affecting the success or failure of the proposal and the long-range implications resulting from the adoption of the plan. These non-economic factors include the political implications, probable cultural changes, international trade relationships, structural changes in the society and other "second generation" problems. A feasibility study must recognize both the economic and the non-economic aspects of the implementation process of new agricultural innovations.

The feasibility study is probably the most difficult part of the entire planning process. It must be conducted by country nationals who can properly evaluate the non-economic factors and make predictions in accordance with government policy. Foreign advisers are of most use in helping the LDC to analyze the economic aspects of the plan. The quality and extent of an in-depth feasibility study will often predict the success or failure of the plan.

Up to this point the implementation plan is still in a fluid state. Several points have been clarified and some aspects of the plan are fairly firm. There are still a few aspects that should be pursued before the actual plan can be written.

Consequences of Implementation

Implementation of a plan for a new agricultural innovation will cause many changes in the society. These changes will include those that will be considered for the better and also those for the worse. Development is such a dynamic process with a complexity of intervening variables that the consequences of implementation are often unpredictable. However, this is not to say that we should not concern ourselves with the consequences. Many of them can be predicted, especially those economic factors at work in the country. Identification of as many consequences of implementation as possibile should be made as the policy and plan are formulated.

The consequences, as they come to be recognized, can change the strategy of the plan considerably.

Various tribes, nations, and social systems of the world have developed a set of cultural characteristics over extended periods of history which are best for them, in their particular situation. Rogers (13, P. 11/5) calls this "cultural relativism." For example, an Iranian farmer repeatedly refused to grow the new dwarf wheat variety. When asked why, he replied, "Your wheat is short and ugly. My wheat is tall and beautiful and waves gracefully in the breeze."

The innocent promotion of an innovation with dire consequences is usually caused by a lack of empathy on the part of planners and change agents. Unless force is applied, the farmer will usually reject the innovation forthwith, much to the consternation of planners and change agents. In defense of their plan for the innovation, planners and change agents (foreign advisers also) will label peasant farmers stupid, ignorant, tradition-bound and fatalists. Peasant farmers would probably have adopted the innovation if the approach had been altered to more closely fit their social, cultural and economic situation.

Planners and change agents should be ever alert to detect adverse consequences and prepared to alter their implementation plan to overcome this adverse situation. Conversely, they should also be alert to positive consequences

and swing their implementation activities more aggressively in that direction.

In conclusion, planners and change agents should keep in mind what Spicer (16, P. 13) says, "Changing people's customs is an even more delicate responsibility than surgery."

Incentives for Adoption

Incentives can be a strong motivating force to encourage the adoption of an innovation by a farmer. Price incentives loom highest on the list. Price incentives are not limited to the sale price of the agriculturul product by the farmer. Those peasant farmers who consume practically all of the product in their home are not greatly affected by the sale price. The price incentive for the agricultural inputs such as seed and fertilizer is much more meaningful to that farmer.

If the innovation is a non-consumable product on the farm such as rubber, tea, coffee, etc., the entire range of price incentives can be put into action. In the case of consumable products, the price incentives should be placed on the inputs, thus causing a marketable surplus of the product on the farm. At this point, the farmer is moved by the market price of his consumable product. Except for isolated instances, all farmers in the world market some portion of their farm production.

The planners must determine where innovations fit into the farmer's production pattern. Then they can determine which of the price incentives will most actively support adoption of the innovation.

Historically, price policy in many LDCs has been negative. Many governments consider higher prices for food crops undesirable because of greater cost to urban residents resulting in unwanted wage increases. The same is true for industrial raw materials that are raised on the farm and processed in urban centers. Even export agriculture is held at depressed prices to allow a heavy export tax on export commodities and still be competitive on world markets. A possible prerequisite for implementation may have to be removal of the price constraint.

Incentives can be used in sectors of the model other than production. It may be necessary to offer import and tax-free concessions to international fertilizer companies to encourage local production in support of an agronomic innovation. They may come in the form of duty free importation of farm machinery. Other incentives paying farmers to store grain on their farms to ease the strain on storage facilities, subsidizing marketing cooperatives to build storage facilities and paying innovative farmers for each fellow farmer he convinces to use the new innovation.

Resources for incentive payments are limited, and selection of the one or two that will best accelerate implementation is a difficult task.

Institutionalization of the Plan

The most prevalent conception of an institution is the "top-down" type as described by Wharton. (19, P. 8) He argues for increased emphasis on the "bottom-up" and increasingly decentralized institutions.

"The most effective execution of agricultural development is that which decentralizes as much as possible those planning decisions to a level where localized knowledge of needs and requirements are best known and which integrates local, regional, and national planning in a 'bottom-up' fashion in those areas where overall coordination is required."

He continues: "My criticism is that 'bottom-up' efforts have been seriously neglected with disastrous consequences - both economical and political."

Let us look at those areas in the implementation of agricultural innovations that require coordination at every level. Basically we are channeling all our efforts toward convincing the production sector to adopt the new innovation. Previously in this chapter we have discussed farmer incentives, consequences of implementation, feasibility studies, and social and cultural constraints. All of these point to the fact that the root of the entire problem of implementation is the farmer.

Would it not, then, be logical that the major institution responsible for implementation should be oriented in

a "bottom-up" approach? This entire implementation organization should be intimately "tuned in" on what the farmer will respond to positively. The only way for this to be accomplished satisfactorily is to involve the farmer in the initial planning process. The starting point for the implementation planning process should be the expressed need by the farmer. Planners should place much weight on information at hand that has come to them directly from the farmer.

Now let us look at some of the institutions concerned with input and marketing. The general tendency is for LDCs to form governmental institutions (often at the insistence of foreign advisers) to handle seed, fertilizer, insecticides and machinery. Credit and marketing also often fall into this category. Planners should look carefully at the tremendous burden these institutions are to an already understaffed and relatively inexperienced civil service. Depending on the particular country situation, it might be well to encourage the private sector to handle the importation, sales and distribution of input commodities. Marketing is almost always traditionally in the private sector but in need of improvement. Credit is urban oriented in a formal sense, but in an LDC many times more credit is being extended to farmers by local money lenders.

In summary, the agri-business side of institutional development should be in the hands of the private sector

as much as is politically possible. On the other hand, the institutional responsibility for research, education, policy, change agents and regulatory services should be the government's responsibility. Governmental institutionalization should be confined to those areas where it can excel while the private sector is free and encouraged to develop those institutions for which they are best suited. According to Esman (5, P. 2) "Institution-building is a guidance and social learning process, not the 'installation' of prepackaged foreign technologies."

Planners should evaluate the developmental capabilities of the institutions that may be involved in the proposed plan. A critical evaluation will no doubt uncover many aspects of the involved institutions that are undesirable. The question then becomes whether to correct the undesirable aspects or create new institutions to handle the job. A word of caution: in almost all cases, it is better to use existing institutions in preference to creating new ones. Existing organizations offer staff, facilities, legitimacy and seniority and would actively oppose formation of a duplicate institution. Create new institutions for only those aspects where no suitable institution now exists.

How does one evaluate the development potential of an institution? Esman (5, P. 6) divides an institution into two general groups of variables: "institution

variables, which are essentially concerned with the organization itself; and linkage variables, which are mainly concerned with external relations." Too often an institutional evaluation looks long and hard at the former and only glances at the external linkages.

For further guidance on evaluation, Esman defines institutional variables as "leadership, doctrine, programs, resources and internal structures." The institutional variables are connected to the linkage variables through "transactions." Linkage variables are identified as "enabling linkages, functional linkages, normative linkages and diffuse linkages." Planners, when evaluating institutions, would do well to analyze institutions using the above mentioned headings.

Supervisory Personnel and Their Functions

Planners. The value of a plan for a new innovation is the implementation supervision. Planners themselves are the major supervisors. The plan should at all times during implementation be considered only a draft. An effective implementation plan should be constantly under revision according to information furnished from all sectors of the model. Planners should actively seek this information through frequent contact with responsible people in all implementation phases. They should also travel to the "action sites" to observe the implementation in action.

Considerable insight into problem areas can be accomplished by planners who understand the overall objectives and inter-relationships of the plan. The supervisory function of the planners is a continuing activity.

Ministry Officials. A considerable amount of the administration and implementation of the plan falls on ministry officials. These officials, to be effective, should consider it to be their plan and accept full responsibility for its implementation. With this responsibility goes the authority and supervisory responsibility. Communication between the planners and ministry officials must be maintained to insure accurate interpretation of all aspects of the plan. Only then can ministry officials properly supervise the activities in the plan. They should exercise the authority to refine the action phases of the plan and make on-the-spot decisions and changes. This authority should be passed all the way down the organization structure. Control of this authority can be realized through reasonably close supervision at all levels and must be held personally responsible for their segment of implementation.

Agricultural Educators. For the purpose of the model, the agricultural educators will be considered anyone who is formally involved in communicating information about the innovation to the uninformed. This would include researchers who train planners, change agents, suppliers,

farmers, change agents and marketing people on certain aspects of the plan. Similar examples could be given for the other sectors of the model.

Probably the most monumental task in agricultural education concerning the innovation is the training of change agents. The successful use of the innovation is dependent upon accurate interpretation of information. This is a vital part of agricultural education. If change agents are taught about use of seeds and fertilizer only, lack of knowledge concerning the companion cultural practices could easily spell failure in implementation. Accuracy in relating vital concepts, such as fertilizer rates, is necessary to display significant observable results.

Educators must exercise supervisory authority over information concerning the innovation. In order to be realistic in exercising authority, the educators cannot restrict their activities to the classroom. They must follow-up their educational efforts to evaluate the effectiveness of their instruction. This would involve observation of students on-the-job and discussions with their supervisors. These contacts should result in constant revision of the presentation to increase effectiveness.

Policy formulation is a dynamic process. The planners are to be considered coordinators of information. This role of a coordinator requires a smoothly operated set of

communication channels with as little static as possible running to all sectors of the model. Assimilation, condensation and evaluation of information is the prime responsibility of the planning people.

The other member of the policy team is the supervisory team. In many cases the same people are involved in both planning and supervision. Planning should take place at all supervisory levels. Often the most effective plans are drawn up by the people who will also be carrying out the plan. These people must be supervised, however, to insure that the plans are in support of the general policy. If the policy is in error in some manner, this problem should be passed on to the policy makers. The subordinate planners should wait for a ruling on the policy before changing their plans.

CHAPTER 5

SUPPLY OF INPUTS

One of the most difficult implementation problems is making available an ample supply of input materials at the right place at the right time. The problem is one of monumental proportions in most LDCs. Within country availability is only half of the problem. The more difficult problem is the logistical one of distribution of inputs within easy access of the farmer. In many cases the production expertise necessary for in-country inputs such as fertilizer and insecticides is available only from foreign sources. In this case an LDC would be advised to encourage foreign companies through import-free and tax-free incentives to bring not only their technology but also management, distribution, sales and capital resources into the country.

The private sector has the capacity and the experience to furnish the supply of inputs. For government to attempt to be businessmen and manufacturers often prevents the innovation from succeeding. Governmental functions in the supply sector should be limited to those functions they can best carry out. In addition to the aforementioned incentives,

these include regulatory functions to protect the farmer, quality standards, transportation facilities such as harbors, roads and railroads, credit guarantees, land reclamation, etc. In all cases, governmental involvement in the supply sector should concentrate on encouraging the private sector to furnish the farmer good quality input materials at a price the farmer can afford.

Often the governmental institutions must "seed the market" before entrepreneurs will consider the venture economically feasible. An example would be governmental importation of fertilizer for an introductory period of three years. The second year the government announces to the private sector that they will import fertilizer only one more year and the private sector is free to do so at any time. If the private sector has confidence in this announcement, they will take immediate steps to set up fertilizer enterprises.

The problem then becomes, will it be more economical to import fertilizer or produce it within the country? The deciding factors for this problem are the projected local demand and the available raw materials. If the product can be imported more cheaply and foreign exchange is not in short supply, it may be advantageous to import the product indefinitely. This would be especially true when considering fairly sophisticated farm machinery and

tractors. Bulky, low cost-by-volume materials may necessitate in-country production because of transportation costs. Transportation costs double the price of delivered in-country fertilizer shipped from Karachi, Pakistan to Afghanistan.

Supply of Seeds

When a new variety has been found by researchers and put into the plan, it is necessary to multiply the variety or strain to make a sufficient quantity available to the farmers. There are several ways to accomplish this. The most expensive way is through governmental seed multiplication farms; this is expensive in terms of personnel, production costs and distribution. A better way might be producing seed through an association or cooperative consisting of farmers who specialize in seed multiplication. In this case seed purity and quality can be easily controlled. Probably the most efficient method of seed multiplication is where very small quantities of seed are distributed to a few farmers in each community in the form of a demonstration plot. These farmers save the seed for their own use and either sell or barter off the surplus to their neighbors. The only problem with this method is the difficulty in maintaining purity.

Seeds as an important base for an innovation have several advantages over the other inputs. Most farmers

need to buy only the initial quantity and can save seed thereafter to supply future needs. If the farmer is of a very low income group, he does not need to place an undue strain upon his meager savings. Seeds are not new to the farmer. They do not in themselves introduce a new technology in selection, handling, storage or planting. Farmers, therefore, accept an improved seed variety faster than the other parts of the innovation package such as fertilizer, insecticides, and machinery.

Supply of Fertilizer

In spite of the required cash outlay, farmers are so startled at the results of fertilizer application that they often make rash judgments. Farmers like the immediate response and the lush growth resulting from the application of nitrogen fertilizer. In most LDCs nitrogen, phosphate and potash fertilizers are sold separately. Consequently, many farmers apply only nitrogen and are dissillusioned when their yield is little better than the unfertilized crop. Since phosphate and potash individually do not show a striking observable difference in growth, few farmers appreciate the value of these fertilizers.

When planning the fertilizer phase of the implementation plan, it would be advisable to consider making available only the mixed fertilizer suitable for the major

soil type of the major producing area and the particular crop involved. This approach would make it possible to market "wheat fertilizer" or "rice fertilizer" and farmers would only need to learn how much to apply to a given area. The bag could have the picture of a wheat or rice plant stamped on the bag to make it easily identifiable for the illiterate farmer.

Size of bag is also an important item when dealing in relatively small quantities. Bag size should be determined by the usual mode of transporting the fertilizer by the farmer from the buying point to his home and on to his fields. In Nigeria fertilizer is packaged in 56 pound bags which are considered the maximum head load for carrying distances of several miles. Another criterion for size is the price of a single bag. If a bag of one hundred-weight is relatively high for a small farmer to buy, he will buy a half a bag. This opens the door for traders to sell short weights and adulterate the product. Also, large bags tend to break open more easily with the repeated handling they receive in most LDCs.

Supply of Insecticides

In the process of agricultural development, the use of insecticides for crop production appears to follow that of seeds and fertilizer. Improved seed varieties fed by

moderate amounts of fertilizer produce abundant lush growth that seems to encourage increased insect populations. At first farmers are reluctant to spend the time and money to control insects which they have learned to accept as inevitable. Not until the insect population grows to large proportions will most farmers start the application of insecticides. Introduction of insecticides too early in the implementation of a crop production innovation will probably be ignored by most farmers.

Most small farmers in LDCs are not comfortable using powerful chemicals. Wood ash or tobacco stems are all they have ever used. Wholesale destruction of living things (insects) is often against their beliefs. At first introduction to insecticides, farmers handle them as they would wood ashes. The danger to their personal health and that of their family is not readily recognized. For this reason, non-toxic multi-use insecticides should be introduced at first so that they can learn to handle agricultural chemicals with the least personal harm.

Size of package is even more important with insecticides than with fertilizer. Packages should be small enough so that the entire package will be used in a normal (small) application. Unused portions stored in farmers' houses present a serious hazard.

Insecticides requiring expensive sprayers or dusters should be introduced after farmers have had some exposure to and successful experience with inexpensive equipment such as cloth shaker bags or garden sprinkler-can applicators. Large semi-mechanized farmers do not need to go through these stages, but in most cases they will adopt insecticide applications without concentrated efforts on the part of change agents. If the insecticide program is aimed at the average or middle-size farmer, the larger farmers will also benefit from the program.

Supply of Machinery

Peasant farmers in most LDCs use only those farm implements that can be made in their home village. Wooden implements predominate. A small piece of metal is usually applied to the wearing points of implements such as a metal sleeve for the wooden plow points. The African hoe has a metal cutting blade.

When we consider mechanization for implementing the innovation, we must first decide the class of farmers we wish to reach. The most dramatic (and the easiest) to reach are the relatively wealthy progressive farmers who are anxious to modernize their operation with American equipment. Foreign advisers feel more confident working at this level for their experience is in this field. The

economic impact of this input can be rapid in terms of both crop production and investment opportunities.

Machinery suppliers would do well to explore also the possibility of making available to the average farmer those implements that are an adaptation and improvement on the present implements. Start with the most important piece of equipment that is most in need of improvement. One of the greatest problems for improving farm productivity is mechanization for the small farmer. His acreage is small and his ability to invest in machinery is low. Slight improvement upon present implements for the average farmer will have a higher lasting impact upon total production than introduction of modern machinery by wealthy farmers.

Farm mechanization is like climbing a ladder. Farmers need to put their foot on each step of the mechanization ladder. We can help farmers to climb faster but we must not encourage peasant farmers to leap from the bottom rung to the top. They will undoubtedly fall.

The critical stages of production that the average farm implements cannot cope with must be considered first. In the case of recent experience with large increases in yield of wheat and rice, the harvesting stage is a bottleneck. Using traditional methods many Asian farmers cannot complete harvest before the next planting season arrives. When faced with this problem farmers are receptive to improved harvesting equipment they can afford to purchase.

Distribution of Inputs

The problem of distribution of inputs within access of the average farmer is crucial. We have often heard of successful extension programs using fertilizer, insecticides or a specific variety of seed that the farmer cannot acquire within 50 miles of his home.

The old army saying, "Don't advance in an offensive beyond your supply lines," applies in this case. Do not demonstrate the innovation in areas that you cannot assure an ample supply easily accessible and at the proper time. It also does little good to have innovation inputs distributed and ready to sell in areas where farmers are still unaware of the innovation.

The advantage of the private sector handling supply of inputs was discussed earlier. An effective distribution system is an expensive undertaking and establishing a separate system for each input is unnecessary. It is much better for the farmers to have one buying station in a community, at least in the early stages. It would be well to encourage the suppliers of fertilizer, insecticides, farm equipment and possibly seed to combine and establish one distribution system. When a second fertilizer supplier comes on the scene, he will team up with a second farm equipment and insecticide supplier to establish a second distribution system. In this manner there is both economy

in distribution and convenience to the farmer plus the competition to hold prices down. Most parts of the developing world market commodities in a bazaar market-stall system. This proposed distribution system may lead the way to more efficiency in the bazaar.

Credit for Purchase of Inputs

Need for production credit in agriculture rises out of the seasonal nature of production; however, consumption of agricultural products is continuous and the available supply diminishes from harvest time onward. Provisions of production inputs requires a saving from the past harvest or credit borrowed against a future harvest. In the early stages of adopting new innovations the requirement for investment by the farmer is relatively small, but his needs increase rapidly with additional participation in the adoption process.

Proper timing for credit availability is critical to the success of a production credit program. Credit must be available well ahead of seasonal utilization of the input and, more important, after the farmer has used his own savings for his initial purchase of inputs. The prime source of financing for farm inputs is the family. Only when this source is exhausted will the farmer resort to other sources. In most LDCs borrowing money by middle and

low income farmers is considered a form of oppression and should be used only as the last resort.

When extending credit for the promotion of an agricultural innovation, one must be sure the credit is for production, not consumption. Mellor (7, p. 315) explains, "Money borrowed for the purchase of seed may be used to purchase seed which would have been purchased in any case and thereby allows expenditure on consumption items which would not otherwise have been purchased." This is not to say increased consumption is not good but that it should come after the farmer has earned the opportunity for increased consumption on a sustained basis.

Planners would be advised to schedule most of their production credit in the adoption phase of the innovation and encourage farmers to use their own finances for the trial phase. Many will claim that the innovation will never get started if we expect farmers to finance themselves in the beginning; however, most farmers have a little "mattress money" available for purchase of sufficient inputs to try the innovation on a small portion of one of their plots. After the farmer has successfully tried the innovation on his farm, he immediately becomes a better credit risk. He then is anxious to spread the innovation to a larger portion of his farm and actively seeks the necessary credit to do so.

He will no doubt seek credit from family members first. This is probably the best source of credit with little or no interest. His next source would be the traditional money lender in the community. Mellor (7, p. 317) states that "in the All-India Rural Credit Survey, 70 percent of the rural credit is handled by money lenders and only 6 percent from cooperatives and government agencies." Interest rates average about 20 percent in India as compared to 6 to 12 percent paid by farmers in high-income countries. The high interest rates in India stem from the high risks and very high administrative costs of loans equivalent to 25 or 50 dollars.

Most foreign advisers look upon money lenders as "loan sharks" who are squeezing the last cent out of the poor peasant farmer. This is not necessarily true. They perform a service to farmers that, thus far at least, governmental agencies in the LDCs cannot furnish without huge subsidies and losses from overhead expenses. Governments in LDCs would be wise to encourage money lenders to continue their service to farmers but to impose a few restrictions to protect the farmer. One of these restrictions should be that all production loans only involve the crop to be produced as collateral and not the land on which the crop is growing.

A possible approach to supervised credit for village farmers might be the combination of the money lender and the change agent. It appears that these two are the best equipped to carry out supervised credit at the local level. This no doubt is taking place to a great extent in a natural manner in those areas of the world where the "Green Revolution" is in progress. Official encouragement of this approach might accelerate the adoption of agricultural innovations.

Transportation Availability

Large scale adoption of an agricultural innovation usually puts extreme stress on existing transportation facilities. The fast and efficient movement of inputs to thousands of farmer buying points is a perplexing problem. Traditional methods of transporting materials seldom can handle the accelerated requirements.

Repeatedly governmental agencies in LDCs have attempted and failed to move agricultural inputs within their countries. This again is a clear case where the private sector can handle the job faster and more efficiently. Government should encourage the transportation industry to expand to make possible the movement of a greatly accelerated amount of inputs. Incentives such as reduced import duty on trucks would help in this case. Another encouragement would be a stepped up road construction program. A network of roads is vital for transporting input materials to buying points easily accessable to farmers.

Functional Model for Agricultural Inputs

In this chapter, we have explored the vital position the private sector plays in supplying agricultural inputs in support of agricultural innovations. Linkages between manufacturers and consumers of these inputs must be maintained. Other linkages with input suppliers would be with research to determine recommended quality and quantity requirements, with planners and policy makers to anticipate need and incentives available for supply of inputs, with change agents to coordinate supply and demonstration of the inputs, and with marketing people to determine future needs and coordination of activities.

Establishment of effective channels of information between governmental agencies and the private sector is difficult. There is mutual distrust and constant maneuvering by both parties to gain an advantage. Extra effort should be exerted by all parties to establish cooperation, coordination, and a team spirit for the implementation of a new agricultural innovation. Undue regulatory control over the private sector can prevent successful implementation.

Static-free channels of information should be established. Constant communication between government and the private sector will eliminate most of the static. A sincere appreciation of the other man's problems can be accomplished through communication.

CHAPTER 6

CHANGE AGENTS AND THEIR FUNCTION

A change agent is any person who attempts to influence others to adopt a decision he deems desirable. Change agents can influence change in both a positive and a negative manner. Basically the change agent is one who communicates new ideas to others. We normally think of change agents as professional agricultural extension workers, both governmental and commercial. In addition, professional change agents include school teachers, politicians, and salesmen.

The change agents who directly affect change to the greatest extent in LDCs are the volunteer communicators. Some examples are traders, migrant laborers and herdsmen, community leaders and truck or bus drivers. These people move about the country and see or hear about things that are new and interesting and pass the ideas on to others. Volunteer communicators are the bridge between the governmental system and the village people. Their function is vital in legitimizing a new innovation. Even more important legitimizers are family members who have left the village to work in the city or obtain higher education. Almost invariably these people are consulted by the family regarding adoption of a new innovation.

Professional Change Agents

Discussing the professional change agent, Rogers (13, P. 257) states "Perceptions of the change agent by his client system may affect his success in securing change. These perceptions vary on the basis of the social characteristics of his clients, and partly determine how much communication a client will have with a change agent. Research results show that change agents reach the upper social status portion of their clientele disproportionately more than the lower strata."

Social status and level of education have a very high correlation in most LDCs. This presents the problem of placing a professional change agent in a village where his educational level is much higher than the average farmer. According to Rogers (13, P. 176), he will probably have contact only with the farmers in the high social strata of the village. More effective change agents would be those with an educational level only slightly higher than the average farmer and equal to that of the better educated farmers of the village. A change agent of this description should have received special training on the subject matter for the innovation and receive close supervision from a change agent of higher education. In this case a supervisor to subordinates ratio should be no more than 1:4.

Effective village change agents are those who identify themselves with the village people and minimize their identity with the bureaucracy they represent. The supervisor would, no doubt, instead identify himself more closely with the bureaucracy.

The Extension Agent

Acceptance and prestige in the village is something the extension agent must earn. This is accomplished in several ways. First, he should establish himself as a resident intending to remain a part of the community indefinitely. He should participate in local social and cultural activities, and, therefore, should already be a member of the ethnic group. He should carefully select his cooperating farmers for the initial implementation of the innovation. He should establish his demonstrations with no less than three cooperating farmers so if one or even two of his demonstrations should fail, he would have at least one that is successful. His prestige is enhanced if he can bring important people from outside the village to see the farmer's demonstration and arrange for a mobile cinema to visit the village. The supervisor has the responsibility of insuring that the village change agent receives the best possible logistical support.

The manner in which the change agent presents the new innovation to the farmer is extremely important. There

are two schools of thought on this point. One approach is to present it to the farmer in small segments such as new seed this year, fertilizer next year, insecticides the next, etc. The other approach is to present the farmer with a new system of producing the crop in question as an innovation package.

The package approach is winning favor over the segmented approach in recent years for several reasons. Each production input factor is interrelated and to use one factor without the others will not give the desired results. Farmers will adopt only those new innovations that show a a striking observable increase over the old method. Maximum results can only be shown when all the ingredients of the package such as seed, fertilizer, insecticides, farm machinery and cultural practices are demonstrated. Farmers readily understand the inter-relationships of the package components. Logistical problems for the village change agents are minimized when he is presented with a literal package of a complete set of inputs for each of his demonstrations.

School Teachers

Village school teachers in the role of a change agent are looked upon slightly differently than the extension agent. Most village people consider education one of the most important aspects of progress. The

teacher is the symbol of education and is held in high regard. He is not only looked upon as the educator of children in the village, but is also consulted by the adults on any matter requiring an educated background. Many problems, such as legal questions, have nothing to do with his training; however, he is used as a consultant, adviser and legitimizer for things pertaining to modernization.

Village schools often have school gardens or small farms as a part of rural education. The teacher will often carry out demonstrations of new innovations on the school land and will then be in a position to speak with authority on the innovation. The school children will carry home information on the new innovation thus alerting their parents. The influence of children upon their parents should not be underestimated by the change agents.

Politicians as Change Agents

In most LDCs over the world, politics play a very important part in the everyday life of most people. Politicians are professionals at swaying people's thinking to their point of view. Professional change agents are usually promoting innovations that have received political sanction and support during the planning stages. The production imports such as seed, fertilizer, insecticides, and

machinery usually have political overtones. Politicians often state, "See what I have brought here to help you grow better crops?"

In most LDCs, politicians have committed themselves to supporting the new innovations. They are constantly promoting adoption with their constituents. In local as well as national speeches these innovations receive constant reference.

Most foreign advisers would prefer to see agricultural innovations divorced from politics; however, this is not the trend in most LDCs. It would be well to recognize the role politicians play as change agents and insure that the content of their speeches and discussions is accurate concerning the innovation. Encourage politicians to visit demonstration plots and experiment stations and possibly carry out the innovation on their own farms.

Communications in a Campaign Approach

When launching a new innovation, it would be well to consider a campaign approach. A campaign approach is one in which all available communication facilities are mobilized to present a new idea and cover the same message through the use of all media. In this case the farmer should hear of the new innovation from many different sources, each telling basically the same story.

The availability of communication facilities differs according to time and place. Each campaign should be tailor-made for the innovation and the situation. Detailed planning of the campaign well in advance of implementation will pay large dividends. Remember that a campaign supports the change agent efforts in the village and in no way replaces him. The campaign will not cause adoption of the innovation. It merely arouses awareness and interest through exposure to the information.

In most LDCs, the literacy rate in the rural areas is relatively low. In recognition of this, the campaign should utilize primarily those methods of communicating such as radio, slides, movies, photographs, tape recordings, etc. In addition, materials could be produced for use by the village change agent such as posters, leaflets, flip books, samples, models, etc. Printed materials should be colorful and predominately line drawings with simple lettered captions. Illiterates can quickly learn to understand line drawings, and the captions can be read by the school children and other literates.

Volunteer Communicators

The effective use of volunteer communicators depends entirely upon their exposure to factual information regarding the innovation. One of the hazards in transmitting information by this means is the misquoted

messages. Often a volunteer communicator overhears part of a conversation or sees a demonstration plot and makes his own assumption as to the inputs and techniques. One of the best ways to reduce misinformation is through a full coverage campaign approach to reinforce the facts via the various media. Radio is one of the most effective reinforcements. The use of mobile sound-exhibit units at the market place also helps to convey the true story to volunteer communicators. A concentrated effort should be made to impress the volunteers favorably and arm them with the correct information.

Community leaders are the most effective among the volunteer communicators. They exert considerable influence in the community and lend creditability to the innovation. These leaders are sometimes termed opinion leaders in the specific area of the innovation. Rogers (14, P. 236) states that "there is very little overlap among different types of opinion leaders." An opinion leader on sheep production is seldom consulted on any other subject. In the village the most effective way to spot the opinion leaders for the innovation is to ask ten farmers at random who they would consult with regard to the particular innovation. The men most frequently named are the opinion leaders. Then attempt to get these men to carry out a demonstration on the innovation.

Another type of volunteer communicators might be identified as traveling communicators. These men are the itinerant traders, migrant laborers or herdsmen, truck and bus drivers, musicians, etc. These people are constantly transplanting ideas. Their credibility is usually not high, but they often fortify an idea by claiming to have seen the successful use of the innovation in a number of other locations. Many of these men are the foreign version of Johnny Appleseed. Through this group of communicators, the word spreads extremely fast over vast areas. In the early implementation stages it would be well to use the audio/visual mobile units in strategically located market places and overnight truck and bus stops to gain the assistance of the traveling communicators.

The Effect of Cultural Patterns

To be effective a change agent must be an accepted member of the culture in which he is working. Professional change agents should be residents of their assigned areas. Most cultures look upon anyone from outside their group or sub-group as an outsider who is not to be trusted.

In chapter four, we discussed the need to have the major aspects of planning, other than economic, done by planners of the host country. This was to insure that the norms prevalent in the country would be honored. Now

we are looking at values and attitudes as they pertain to the cultural pattern. Values change from area to area and even village to village. Attitudes change constantly in all locations.

This prompts Rogers to say that (14, P. 57), "If we know what a society's culture is, including its particular system of values and attitudes, we can predict with a fairly high degree of probability whether the bulk of its members will welcome or resist a particular innovation."

CHAPTER 7

PRODUCTION FACTORS LEADING TO ADOPTION

Adoption of the innovation by the majority of the farmers who produce a particular agricultural commodity is the sole purpose of this entire presentation. Measurement of success or failure can be made in several ways. The economists measure the increase in total production and the net benefit to the economy as a whole. Agriculturalists measure the increased yield and net profit per acre. Politicians measure the apparent attitude of their influential constituents. Businessmen measure the amount of their product sold as a result of the innovation. The consumer measures the quality and price of the product in the store; however, the best yardstick for success of the entire process of implementation of an agricultural innovation is the number of farmers adopting the innovation on a permanent basis.

As evidenced by the Congressional Hearing on The Green Revolution (17), most of the evaluations published on the "Green Revolution" record its success in terms of acres planted, increase in total production, amount of new seed planted, increased fertilizer consumption, and ability to feed a growing population. Few, if any, evaluations

measure the number of farmers using the innovation. Reports of an even wider gap developing between peasant farmers and wealthy farmers in terms of income, standard of living and development potential substantiate this.

Throughout this paper the average farmer has been stressed. Implementation of an innovation must be geared toward adoption by the average farmer. The wealthy and innovative farmer will readily adopt an innovation of benefit to him without undue effort from the change agent. The production problem is not so much how to encourage total production increases through use of the new innovation as it is one of how to get the average farmer to adopt the new innovation.

The Farm Family

The basic production unit for agricultural products is the farm family. Implementation efforts for a new innovation must all be channeled into the utilization of the many inputs by the farm family. These people are far more than merely a labor force. They are the managers, the economists, the evaluators and the producers of the agricultural sector of the country. The decisions made by the farm families, right or wrong, determine the future development of most LDCs.

Planners would be advised to keep in mind throughout the entire implementation process the reaction each

decision will have on the farm family. Planners should have empathy with the farm family. What may appear irrational to the planner and foreign adviser, may be entirely rational for farm families in their environment. Successful implementation of an innovation requires recognition of environmental blockades. Corrections to the environmental climate to permit adoption of the innovation are necessary. This is not a problem of input availability but one of a set of values and attitudes of the farmer, his land tenure situation, his level of comprehension and the existing social and cultural pressures.

The adoption of any new innovation upsets the farmer's list of priorities. The farm family evaluates a new innovation in terms of whether they are willing to alter their priorities to the extent necessary to accommodate a new innovation. For example, they must decide whether to use their meager savings to purchase seed and fertilizer or to use the money for clothing as planned, or to sell some of their sheep to obtain the money. In any case, the reaction within the farm family is according to the domino theory: One change causes changes in the whole. Farm families recognize this which may explain why they are often reluctant to accept a new innovation no matter how advantageous it may be. Some farmers may initially adopt

a new innovation only to drop it later when these many emerging problems appear not to be worth the changes necessary in farm operation. At this point the village change agent can help by encouraging the farmer to see more clearly how these changes can easily be made.

The Land Situation

Farmer reaction to new innovations often can be negative because of a lack of security or ownership of the land. If the farmer is a tenant and does not know from one year to the next if he will be farming the same piece of land, he will be reluctant to make any investment that remains in the soil. Sometimes the farmer who owns the land knows that if his land becomes more fertile his creditors will foreclose. Farmers in most LDCs look upon control of the land as their control over their income and security. Farmers with control of their land are more apt to adopt new innovations than those with little or no control over the land they are farming.

Prevailing Level of Knowledge

We often think of knowledge and literacy as having a high correlation. This is not necessarily true. Formal education and literacy have a high correlation but knowledge is also acquired through a series of experiences.

The poorest illiterate peasant farmer possesses considerable knowledge about some subjects - usually those subjects having to do with nature.

For the purpose of implementing an innovation, the planners should ascertain the prevailing level of knowledge of the farmers in the area of the new innovation. An innovation should not be attempted if its implementation requires technical comprehension far above the level of the farmer. There are adaptations that can be applied to highly technical information to make it understandable for the peasant farmer. Often these adaptions require a compromise on the part of research people in regard to optimum yield. Extension staff should be alert to this situation and take the initiative in negotiating a compromise in the recommendations with the research people.

Influence of Incentives for Adoption

The most effective method to accelerate the rate of adoption of a new innovation is the judicious use of incentives. Incentives are of various types such as production incentives, price support, need for material goods and social prestige. These factors, when used properly, are powerful forces for encouraging farmers to adopt new innovations.

In Chapter Four, we discussed price incentives for agricultural inputs. Several additional incentive factors

are at work in the village. In all societies the wife has considerable influence over decisions regarding new innovations. She can be the driving force behind adoption as is dramatically shown in the movie "A Future for Ram" (17, P. 163). Through her exposure to modernization she may push her husband to earn the extra money for a sewing machine. Home economics and rural sanitation programs are often indirect influences on adoption of agricultural innovations.

Prestige is a powerful incentive in the village. A man who is considered a "progressive farmer" by virtue of his successful use of new innovations is generally well respected by his fellow farmers.

Farmers react positively to economic incentives unless cultural or social constraints inhibit them. Wharton states (18, P. 6), "The evidence is quite clear that, given a favorable economizing setting, subsistence man is highly responsive to the opportunity for a larger income (higher gain beyond costs and effort spent)."

Social Pressures on the Adopters

There are both positive and negative social pressures brought to bear on those innovative farmers who are the first to adopt new innovations. Village people laugh at a farmer who would sprinkle sugar (fertilizer) on his land. Outright hostility sometimes breaks out when the village

elders feel the good and stable life is threatened by outside influences they cannot control.

Often the innovative farmer is not free to try out the new agricultural innovations on his land for he knows full well the consequenses. This presents the problem for the change agent of how to approach the village people with a new innovation. There is no general answer, for each village in each country presents a little different situation. A few points to consider are: 1) determine the norms and values of the people and present the innovation in such a manner that there will be no confrontation, 2) approach the village leaders, first individually and then collectively, to gain their endorsement and support, 3) consult with opinion leaders and encourage them to try the new innovation, 4) hold an open village meeting where village leaders and opinion leaders publicly voice their approval for the innovation. If these four points are successful, the change agent has turned what might have been negative social pressures into positive social pressure in support of the innovation.

Difficulty of Methodology

The majority of farmers in LDCs do most of their farming by hand on small plots of land. Many of the new innovations are discovered on experiment stations using highly mechanized methods of production. As a

result, many of the recommended practices for the new innovations have very precise instructions for production: for example, precise depth of planting the seed, exact placement of fertilizer, and detailed instructions on how to spray the crop are given. This type of recommendation presumes the farmer who will use the recommendations will have available to him the same or similar equipment. This is one of the contributing factors for the wealthy innovative farmer to have the advantage over the average farmer.

This situation need not exist if the change agents are innovative themselves. Extension specialists can adapt the recommendations to the farm machinery the farmer has at his disposal. Placement of phosphate fertilizer two inches below the seed at planting time is an example. For a hand farmer to do this would be impossible; however, if he is ridge farming (listing) and he normally plows by splitting the old ridge by hand to form a new ridge in the old furrow, he could broadcast his phosphate in the old furrow prior to ridge splitting and accomplish about the same thing as the machine planter with a fertilizer attachment. The hand farmer carries on with his hand planting on the new ridge as always. The only change from his traditional method is broadcasting phosphate fertilizer in the old furrows before plowing. If the methodology is simplified to nearly meet research specifications and still not

cause too great a change in the normal farming procedure, the innovation will meet with far more acceptance by the average farmer.

If research recommends 41 pounds of nitrogen mechanically spread over one acre, is it not possible that 35 to 45 pounds hand broadcast over an acre would give almost the same results? Of course, optimum results cannot be achieved with hand farming, but why is it that maximum yield plots throughout the world all involve a high degree of hand labor?

Investment Requirements

Simplification of implementation recommendations can often reduce the investment requirements substantially. About the only manner to obtain universal acceptance of a new innovation is to require very little investment of additional labor, money or management ability. If the innovation can be so designed as to require only those raw material inputs such as seed and fertilizer, the farmer will more readily adopt the practice.

In most LDCs the cost of the raw material inputs are subsidized in the beginning stages of introduction. The subsidy is planned to be reduced gradually as soon as farmer response is evident; however, politicians are often reluctant to reduce the subsidy for fear of a negative rural reaction. They are later forced to make an

abrupt reduction in subsidy because of a drain on the treasury from the high volume of sales. Subsidies should be used with caution and a firm policy.

The Adoption Process

In this chapter we have been looking at some of the factors leading toward adoption. Now we shall look at the stages each farmer passes through in the process of adopting a new innovation.

Rogers' concept of the adoption process (13, P. 81) involves five stages: 1) awareness, 2) interest, 3) evaluation, 4) trial and 5) adoption. The most critical evaluation of a new innovation, however, comes after the trial and before actual adoption. Without a satisfactory evaluation after the trial stage, adoption will never take place. Therefore, let us consider the adoption process as a six-stage process including "re-evaluation" after the trial stage.

In the awareness or exposure stage the individual hears of the innovation but lacks much of the information concerning the innovation. Mass media are very effective at this stage.

At the interest stage the farmer is curious and begins looking for information concerning the innovation. The change agent and certain of the media are involved at this stage. Radio and mobile audio/visual units help

project this information to the farmer. If additional information concerning the innovation is not readily available, the farmer will probably forget the idea.

Evaluation of the innovation in terms of the individual's situation is automatically the next stage of the adoption process. It is at this stage that the farmer decides whether the advantages outweigh the disadvantages. He then decides whether or not to try it. Again, the change agent can be of assistance helping the farmer recognize the advantages and disadvantages, but the final decision is a personal matter.

The trial stage is a validity test for the farmer's decision that the innovation is advantageous for him. He carries out the innovation on a small scale for this test. The change agent can be very helpful here by offering a demonstration opportunity to the farmer during the initiation phase. Thereafter the farmer would have to find his own materials for his trial.

Re-evaluation comes after the validity test or trial. If the innovation was satisfactory in the trial stage the farmer's re-evaluation would cause him to seek the means to adopt the innovation permanently on his farm. Availability of the necessary inputs and possibly credit for their purchase are crucial at this stage.

In the adoption stage the new innovation is completely absorbed into the farming system. This does not necessarily

mean that, for instance, 100 percent of the wheat or rice will be of the new variety. Traditionally most farmers raise more than one variety for filling special needs. It does mean that the farmer has accepted the new innovation on a permanent basis.

The rate of adoption varies with the individual, his motivation, social awareness and economic situation. Some individuals will move rapidly through the six stages of adoption while others will remain at the awareness stage indefinitely.

Rogers (13, P. 110) places adopters into several categories: the innovators, the early adopters, the early majority, the late majority, and the laggards. Another category consists of non-adopters. An innovation is seldom adopted 100 percent. It is difficult to assign a percentage of the farmers to each category because of wide variations in the innovations themselves. A rule of thumb might be: innovators, 2 to 5 percent; early adopters, 10 to 15 percent; early majority, 25 to 40 percent; late majority, 30 to 50 percent; laggards, 10 to 30 percent. Those involved in implementing an innovation should continue to participate actively into the early majority category. In this category the change agents, research people and some of the planners ease out of the picture and the input suppliers and marketing people accelerate their activity. The late majority and the laggards will eventually adopt the innovation without further effort.

CHAPTER 8

MARKETING -- PURCHASE AND DISTRIBUTION

A ready market for the agricultural commodity that the innovation produces is vital to the continued production of the commodity. Mosher (8, p.63) considers ready markets the first essential for development. Rapidly expanded production of the commodity requires an equally rapid expansion of the marketing facilities. Traditional marketing systems in most LDCs are not capable of expansion at the rapid rate needed to facilitate the handling of a large increase in total production. Planners should analyze the total marketing system and determine the probable bottlenecks. In most cases, several of the steps a commodity passes through could be eliminated without any measureable change in flow of the commodity in the marketing system.

Most LDCs have made tremendous strides in improvement of transportation and storage of agricultural commodities; however, in most cases these developments have merely been absorbed into the traditional marketing system. The "Green Revolution" is forcing many LDCs to alter their traditional system to accommodate a rapid increase in production. Many of these alterations are of a "stop-gap" nature and contain many weaknesses.

The anticipation of "second generation" problems was discussed in Chapter Four. Marketing is one of the major second generation problems. Planning in anticipation of marketing the increased production should concentrate on both the purchase of the commodity from the farmer and the distribution and handling of the commodity after purchase. Three main areas of purchasing are: the buying system, the quality control standards, and the price fixing system.

The Buying System

Traditional buying systems fall into two main categories: that where the farmer delivers his commodity to the buying point and that where a buyer comes to the farmer and purchases the commodity. The realized price to the farmer is usually far less when the buyer comes to the farmer. Farmers who do not frequent the market place are not informed about the current price and often accept far less than the going price from the traveling buyer.

The location of the farmer in reference to the buying station permits the services of an intermediate buyer. Planners should explore the possibility of expanding the number of buying stations so that all major producing localities are served by at least one convenient buying station.

Quality Control Standards

Over the years, buyers have taken advantage of farmers

by claiming the quality of the product is low when in actual fact it is not. Few LDCs have an effective quality control standard that is respected by the buyers and understood by the farmers. Many LDCs have established quality standards but there is no enforcement nor educational program to acquaint farmers and buyers of those standards. Agricultural commodities for export are usually inspected for quality prior to export; however, this inspection usually takes place in the assembly area and the shrewd buyer is one who makes a profit from a high quality product, not the farmer.

When large increases in production take place, the quality control system usually breaks down. The product is dumped into large "field run" piles, and farmers are not paid for quality but for quantity only. A corps of well-trained government grade inspectors strategically located would help alleviate this problem; however, the greatest assistance to the acceptance of quality control standards would be a concentrated educational campaign aimed at farmers and buyers alike.

Price Fixing System

In order to effect an equitable price fixing system a universally accepted money system and a standard set of weights and measures must be adopted. In the rural areas

of many LDCs, farmers still use the barter system and stones of various sizes are used for weights. In some areas volume measure is a local quantity and differs from one locality to another. This confusing state of affairs allows the shrewd trader to offer short weights and volume to farmers without their realizing it. Standard price fixing under these circumstances is extremely difficult. For this reason the system of bargaining has been established for hundreds of years. Planners should consider a government established, universal money system and standard weights and measures as a first requisite for development in rural areas.

Price ceilings and floors are price fixing techniques so complex in nature that few LDCs should consider their use. Where they are successful, a virtual governmental monopoly exists, and in most cases the farmer is receiving less than he might in a free market situation. The most common price fixing situation is where government marketing boards buy from the farmer, grade the commodity, transport it to the nearest port and sell it abroad. In Nigeria (6, p. 20), marketing boards were successful until they fell into the hands of the politicians.

Price fixing in most LDCs follows a fluctuating pattern of supply and demand. Farmers respond positively to these fluctuations, but their response is reflected one year

after the fluctuation. Behrman concludes (1, p. 240), "The results of this study suggest that the government should avoid introducing distortions into the relative prices of products and factors because peasants do respond significantly to the existing price structure. In the unlikely event that government has sufficient information to stabilize market prices without incurring great costs in storage or in other activities...medium-term stabilization may be desirable."

Distribution and Handling

Transportation, storage, handling and distribution of agricultural commodities are primarily in private hands. Governments generally provide assistance, encouragements, and a certain degree of control over the private sector in this area.

The greatest encouragement to transportation in most LDCs is the construction of a network of all-weather roads plus a complementary network of secondary "farm-to-market" roads. Government has the sole responsibility for road construction, and it is a very expensive undertaking. From an economic standpoint, the road network should first be built in the most productive agricultural area. When that network is completed, roads should be built in the next most productive area. Unfortunately, politics often over-

over-ride economic feasibility and many LDCs exhaust construction funds on "political roads" before the highly productive areas have roads.

Planners should take special note of the existing road situation in the areas where the innovation would be implemented to ascertain whether the additional product could be easily transported to market. Seasonal variations in rainfall sometimes cause farm-to-market roads to be closed for several months at a time when the commodity should be moved out of the growing area.

Most LDCs suffer from lack of suitable storage for agricultural commodities. The lack of on-the-farm storage forces farmers to sell at harvest time only to have to buy later in the year at a higher price because their quantity stored at home is exhausted. In years of bumper crops some LDCs, like Iran in 1968, are forced to export at harvest time because storage facilities cannot hold the entire harvest. When planning for a new innovation both the on-farm storage and central storage should be considered. Special consideration should be given to insect control in storage.

Handling of perishable commodities requires a large investment in either packaging or processing. All agricultural commodities are perishable to a certain extent, but those with a short usability time span are extremely difficult to handle. Each commodity has its special requirements

and to market it rapidly in peak of condition requires a marketing system few LDCs have at the present.

Distribution of agricultural commodities to those areas of short supply and relatively high demand requires first a good communication system and secondly the transportation and storage facilities to move the product quickly. Coordination is the most difficult part of distribution. Not only must internal coordination take place at the local and provincial level, but it also must take place between provinces and regions of the country. The nerve center for the distribution system is usually in the capital city where the main coordination between provinces and regions as well as export quantities is determined. How capably the coordinators function is very important to the entire distribution system. Lack of a market intelligence service can prevent coordination and present a situation where an extreme shortage exists in one part of the country while a large surplus in the same commodity exists elsewhere.

In summary, Brown states (2, p.90) concerning the new "Seeds of Change" that "Governments in the poor countries... must address marketing with a sense of urgency matching that required to achieve the explosive grains in food production. Without such an effort, many of the potential gains may evaporate."

CHAPTER 9

DISPOSITION OF THE COMMODITY

All agricultural commodities are produced to meet the needs of the ultimate consumer. The quality, quantity available, the price, the taste and the appearance of the product determine the consumer reaction. Consumer preferences are important. There is nobody more particular than the one who purchases the food for the household. When farmers sell their produce it must meet the rigid standards set by the customs of the society. This fact is so well understood that farmers will keep the lower quality food for their home consumption and sell the premium quality produce.

In the early stages of the development of an innovation, the product should be given a consumer preference test. A palatability test alone is not enough. It must also be tested for appearance, quality and general preference. The consumer preference testing should be done in all representative areas of the country. If the product is to be exported, sample shipments should be made to all prospective buyers.

A strong consumer demand for the agricultural commodity will insure a ready market. The projected

population explosion predicts a continuing steady demand for almost all types of foodstuffs produced. The major problem appears to be to present the agricultural products to the consumer at a price he is able to pay.

Planners should ascertain, in addition to consumer preference, the amount of the product that would be consumed locally, regionally, nationally and the expected amount that could be exported.

Local Consumption

Those agricultural products that can be consumed locally are primarily the food and fiber crops. The farm family usually consumes about half or more of the food crop produced, especially if it is the staple food. If it is a specialty crop, family consumption would be considerably less. As the quantity of food produced increases, the amount consumed by the family will increase only slightly. Additional locally produced food will be utilized by non-agriculturalists in the village and nearby town. Normally, local distribution of agricultural products of all types to local consumers is no problem. The problem that arises is how to determine in advance the local surplus available for shipment outside the local area. Planners should be sure to figure an ample amount to remain in local storage to guard against any future unforeseen shortage in production. The actual figure

available as surplus to the local area is never known until the total harvest is in and local sales completed.

Regional and National Consumption

After satisfying local consumption requirements, the surplus agricultural commodities are shipped to the regional cities. Consumers in the cities of the region generally have the same preferences for foodstuffs as their rural neighbors. Normally no consumer bias is evident within a regional area, but often there are different consumer preferences between regions of a country. If there is a different consumer preference for the agricultural product produced by the innovation, planners should be aware of this. Shipment of the produce into a region that prefers a different type or variety will cause marketing problems and tie up storage facilities.

Normally the flow of surplus agricultural production from the local areas will go in the direction of the larger town adjacent to the local area until consumer requirements are met. Then the surplus of that town is sent to the nearest next larger town to meet their needs. Finally, when the needs of the consumers in all the towns and cities have been met, the region will declare any regional surpluses available for transfer outside the region. Food shortages have been experienced in most LDCs and each

region will make sure that there is sufficient food for its population before allowing any export of food outside the regional boundry. The same situation exists for export of food outside the country.

The flow of agricultural production as described above gives partial explanation of why, in years of short food supply, the larger cities in the LDC show the first signs of shortage and usually suffer the most. Equitable distribution of food supplies is a difficult problem. Planners should devise methods adapted to each country's situation to insure equitable food distribution throughout the country. One possibility would be to enforce a rule that for each load of food leaving a local community for nearby towns another load be sent to the large cities. This would start an earlier flow of relatively cheaper harvest time food toward the cities. Prices have much to do with distribution of food. Generally food prices are higher in the cities than elsewhere in order to draw shipments away from small town destinations. This causes the general cost of living to be higher in the cities. It is a challenging problem for planners to organize a system that will put foodstuffs into the hands of city laborers at a price equitable with that of his rural brothers.

International Export of the Commodity

If the agricultural innovation is connected with a product grown entirely for export in the raw state, it is a relatively simple matter to expedite. The main problem is competition on the world market, with regard to both price and quality. An ever increasing number of LDCs are establishing processing plants for export commodities in an attempt to gain a larger share of the product's value for the producing country. Many export commodities enjoy a much larger world market with the product at least partially processed.

The advent of the "Green Revolution" has changed the entire picture for those countries who traditionally exported food grains. Many of the grain deficit countries are now becoming self-sufficient in staple food grains, and wheat and rice are fast moving into a surplus on the world market. Already planners are looking for alternate uses for food grains and substitute crops to grow in place of rice and wheat. Planners would be advised to carefully explore the world market situation of the agricultural product before embarking on implementation of an innovation in cereal grain production.

Looking into the future, Brown (2, p. 12) summarizes the situation as follows, "A crisis in the world grain market is imminent because the food-production breakthroughs

are occuring just as Europe and Japan are pursuing highly protectionist agricultural policies. The stage is now set for a major confrontation between the rich and poor countries over how to rationalize world agricultural trade. The pivotal question is whether the rich countries that do not have a comparative advantage in cereals are prepared to open their internal markets to cereal exports from the poor countries."

CONCLUSION

The implementation process is the core of agricultural development. An understanding of this complex and dynamic process by agricultural advisers can accelerate agricultural development in the less-developed countries of the world. The technical agriculture advantages of the more developed countries can be transmitted if the basic process of implementation is followed.

This paper is not intended to furnish the answer to the problems of implementation. If it serves as a tool to stimulate innovative thinking in agricultural development, the author will have achieved his purpose. Hopefully this paper may open doors to further searching and researching on the details and refinement of the implementation process.

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