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SUMMATIVE EVALUATION PLAN

LONGITUDINAL INVESTIGATION

Honduras Site
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A. INTRODUCTION

1. Background

The CTTA Project is based on the hypothesis that well planned and appropriate multi-media communication strategies that support and complement agricultural extension activities, normally based on inter-personal interaction, can generate widespread adoption of technologies among farmers. Several reasons have led to believe that multi-media communication strategies in combination with interpersonal interaction are more cost-effective than interpersonal interaction alone. Among the most relevant we can mention the following. One, media such as radio and print materials can have higher coverage than extension activities per se. Two, technology transfer messages can be taylored to fit the needs of specific audiences thus making them more persuasive. Three, message delivery may take place when it is most needed by farmers. Thus, it is not only timely, but also targeted. Four, extentionists can systematize both their knowledge of the target audiences and the messages that they must deliver to sub-populations of farmers. And five, farm extentionists may learn how to adequately use audio-visual materials prepared through project activities, and how to best take advantage of previously untapped or ignored information networks utilized by farmers.

Putting it succinctly, the CTTA methodology calls for audience analysis, message tailoring after adequate development and testing of educational materials, and permanent monitoring. It is expected that in the course of project implementation, the different aspects of this methodology will be institutionalized. Institutionalization of the CTTA methodology includes the training of a core staff of professionals capable of properly applying it at the end of the project. It also includes the creation of adequate organizational structures that would permit such trained professionals to perform. Underlying the existence of such structures, one would expect to find both policy determinations and budgetary allocations in support of technology transfer activities based on the CTTA methodology.

An important additional aspect of the project is its expected contribution to the development and/or consolidation of linkages between the elements of the agricultural knowledge system. That is, the linkages between research, extension and the farmer. The project will determine the areas in which farmers' technical knowledge and behavior needs are to be corrected, complemented or innovated. Research is expected to propose solutions to existing technological deficiencies in order to generate message contents to be disseminated through the project's communication strategies. The CTTA methodology calls for extension activities to be incorporated to such strategies. The institutionalization of project activities, thus, also includes the creation or support of mechanisms that can enhance coordination between the different elements of the knowledge system outlined above.

2. Role of the Summative Evaluation

a. Major Objectives

The project calls for a summative evaluation. This evaluation, expected to provide information about the total impact of the project, will be utilized to make decisions regarding the usefulness and applicability of the CTTA approach in different contexts. As a result, it must identify and explain project impact both on the target population and on the implementing agency.

Regarding the target population, the summative evaluation must identify the marginal effect over traditional extension activities that multi-media communication strategies have on technology adoption. Because of the intervening variables that may affect agricultural practices, this evaluation must make the distinction between project impact on farmer knowledge and on farmer behavior. In the specific case of behavior, the summative evaluation must capture not only the fact that the farmer has changed his practices, but also how well he is performing with respect to technical recommendations being disseminated. This evaluation must also identify, on the one hand, the impact of adoption on productivity and gross farm income and, on the other, the implications of farm income variations for both subsistence and market oriented producers. **(DENNIS: Read the last sentence very carefully and determine need to delete.)**

With respect to project impact on the implementing agency, the summative evaluation must accomplish three main tasks. One, identify appropriate criteria to determine the occurrence of institutionalization. Two, isolate the variables that explain why institutionalization has taken place, if in fact it occurred. And three, draw lessons on the variables that must be manipulated to maximize the probability of institutionalization occurring.

Examples of criteria to be utilized in determining the occurrence of institutionalization which may lead to the isolation of explanation factors follow.

1. Increase in the number of trained staff in the implementing agency's communication office with responsibilities for the continued implementation of the communication approaches and strategies developed in this project.

2. The establishment of a system of continuous training for extension staff in the development and use of communication materials and a integrated communication strategy.

3. The continuous coordination between extension and the communication office in the refinement and implementation of an integrated communication strategy as an integral part of the extension strategy.

4. The establishment of a forum for interaction among the research subsystem, the extension subsystem and farmers on the appropriateness of technology being developed and recommended.

5. The establishment of a forum for planning, monitoring and evaluation of agricultural communication strategies.

6. Increases in budgetary allocations and improvement in the availability of teaching facilities for the communication office and the extension service.

The summative evaluation must also deal with assessing an aspect of institutional performance: improvements observed in extension services. Extension services will have a double role when establishing causal linkages between communication strategies and technical adoption. It is expected that the project will train extentionists in the use of: (a) certain elements of the CTTA methodology, and (b) project produced materials to improve their performance. From this perspective, extension services is a dependent variable affected by project activities. However, since the improvement of extension services may lead to increases on adoption, these services become an independent variable for final project outcomes. The summative evaluation will take into account the intermediate position of extension services of the project's causal chain.

b. <u>Elements of the Summative Evaluation</u>

Farmer impact and institutional impact are problems of different nature. The differences in nature of these problems determines the need for using different methodologies to study them. Farmer impact may be studied through a longitudinal investigation using an experimental or quasi-experimental design

where survey methodology may be employed to establish quantitative comparison between experimental and control groups not necessarily randomly assigned. The longitudinal investigation may be complemented by discrete in-depth studies following an ethnographic methodology. The discrete studies would shed light on questions discovered through the longitudinal investigation. They would also be useful to formulate or confirm interpretations made of the findings of that investigation. Institutional impact, however, may be more properly studied through an approach that would obtain qualitative data by combining two procedures. One, institutional analysis techniques emphasizing policy enforcement and working procedures and standards. And two, in-depth interviewing of different actors involved in the process, and who would belong to different levels of the decision-making and implementation hierarchy.

The summative evaluation of the CTTA Project in Honduras will be composed of different elements. As described above, farmer impact will be measured through a longitudinal investigation. This investigation will be complemented by discrete studies. In the case of the longitudinal investigation, data collection will take place at the end of each cropping season. In Honduras, there are normally two cropping seasons per agricultural cycle: one during the rainy season and one during the dry season. The discrete studies will be carried out between cropping cycles. Institutional impact will be studied through institutional analysis and in-depth interviewing of relevant actors. Progress made toward the achievement of institutional impact indicators will be reviewed annually. This review will take place during the first quarter of the subsequent year for which progress will be assessed.

3. Structure of this Report

This report deals mainly with the longitudinal investigation, and it is composed of four main sectors. The first one includes a discussion of the major issues associated with the longitudinal investigation, a presentation of the model guiding this investigation and the way in which the model will be operationalized. The second section includes the methodology to be utilized in the investigation. That is, its design, the sampling selection procedure to be utilized, the criteria for determining the sample size, the structure of the questionnaire with examples of specific sections, and a presentation of the type of data analysis to be conducted. The third section will include the tentative budget for the longitudinal study throughout its life. The fourth section will include the calendar of activities to be implemented for this study during the duration of the project.

B. THE LONGITUDINAL INVESTIGATION: MAJOR ISSUES AND MODEL TO BE ADOPTED

1. Major Issues

The major objective of the longitudinal study is attribution of changes observed in knowledge and behavior regarding agricultural practices to the communication strategy adopted by the project. To increase the possibility of attribution and control for confounding variables, the longitudinal investigation is confronted with two major issues. One, the construction of a sample either representative of all possible sub-populations of farmers in the Comayagua Region or representative of only that sub-population of farmers more prone to agricultural innovation. Two, the need for a constructed control group which would permit us to understand the impact of variables characteristic of the Honduran context during the project implementation period, such as specific trends in the economy and climate that are likely to affect agricultural performance. And three, the need to focus impact research only on certain crops and technologies.

a. Who to Interview?

Studies conducted in Honduras (ATAC, 1975; Kawas and Zuniga, 1979) to depict small farmers, including those cultivating basic grains, have suggested that there are certain variables which increase the probability of openness toward technological innovation. These variables, not in order of importance, are: integration to the market economy, social status within the community, and level of instruction. Based on these findings, it may be argued that farmers producing mainly for the market, occupying social leadership positions, and with higher levels of instruction are the ones more likely to learn and practice the technological innovations to be disseminated through the CTTA interventions. If these farmers fail to try and eventually adopt such innovations, producers less inclined to change would probably be little affected, if at all, by project activities. That is, subsistence farmers, characterized by their anonymity, and with low levels of instruction, if not fully illiterate, would not be expected to show significant modifications in their behavior as a result of the communication strategies implemented through the project. Following this reasoning, one may argue that to respond to the attribution question it would be sufficient to study only the sub-population of potential innovators. To do so, proxies for variables affecting technological adoption openness, such as access to road infrastructure for market integration and farm size for social status, could be utilized to construct a sample frame. The universe from which selection of subjects would take place would be defined by criteria such as: location of farm within an established influence area (e.g., 3 kms radius) for the existing road network, and farm size above a given threshold (e.g., 20 has). Farmers to be interviewed would be those farming, within

the defined road radius, holdings of established sizes.

This approach is likely to increase the chances of identifying project impact, thus in turn augmenting the probability of proving the usefulness of the CTTA methodology. However, it would have major limitations. First, by the mere fact that it would increase the chances of identifying impact, it may lead us to overestimating it. Second, it would not allow us to determine what was the project's overall impact. And three, because of the variables that in the Honduran context help explain increments in the openness towards technological adoption, it would suppose disregarding an important project goal both for designers as well as implementors. That is, reaching the bulk of farmers characteristic of most third world settings, Honduras included. These are producers of basic staples which tend to both live in isolated communities and cultivate very small holdings.

The summative evaluation will be concerned with identifying the project's overall developmental impact. Consequently, the sample will be drawn from all sub-populations of farmers that the project is trying to reach, and not only from a specific group. That is, the innovators, or more precisely identified based on the Honduras experience, the innovative farming "elite". Because in Honduras, the implementing agency is focusing on producers of annual crops, the criteria for defining our universe will be precisely involvement in annual crop cultivation, be it basic grains, vegetables or any combination thereof. A more detailed discussion of this issue may be found in Section C.2 below which deals with sampling.

b. Is a Constructed Control Group Needed?

Research literature distinguished between three types of variables: independent, control, and dependent. Independent variables are those referring to the treatments to be carried out. Control variables are those that are known to influence the phenomenon that the researcher wishes to modify independently of the treatment. Dependent variables are the changes that the treatment is expected to produce.

To isolate the impact of the independent variables, researches work with two groups of subjects: experimental and control. Experimental subjects are those that receive the treatment. Control subjects are those that do not receive it. To test working hypotheses, comparisons are made between experimental and control subjects. This exercise, however, is not sufficient to establish causal linkages between independent and dependent variables. Researches are obligated to take into account control variables, which must be held constant either in reality or symbolically, to answer the attribution question.

As it will be explained in more detail in Section B.2, where the model guiding the longitudinal investigation will be presented, this research will be including certain control variables which are known to influence technological adoption, independently of technological dissemination strategies. Examples of these variables are land characteristics such as slope and fertility, and access to services in support of agricultural production such as credit and marketing.

Despite the exertion of these controls, the developmental investigation is confronted with the need to determine the extent to which a control, or a non-treatment, group is needed. And if so, what characteristics should it have, and how it should be selected.

To begin responding to the need for a control group question, the distinction between the types of possible control groups in the longitudinal investigation must be outlined. The possibilities are: reflexive, statistical and constructed control groups. Reflexive controls exist when subjects serve as their own controls. Statistical controls refers to the use of statistical methods to screen non-treatment subjects selected from the general population. The screening is based on variables believed to be relevant to determine net effects of independent variables. Control group subjects are statistically compared to experimental group subjects on those variables, whose influence is kept constant. Finally, constructed controls refers to the deliberate selection of a non-treatment group not from the general population, but rather from one of its segments: that which is believed to be similar to the experimental group on variables of interest. The only difference between the control and experimental groups is the presence of the treatment. An important aspect of constructed controls is matching. Matching, however, may be done in an aggregate fashion. It need not be done individually. Aggregate matching would be done, for example, when farmers in one area are compared with farmers in another; both of these areas believed to be characterized by similar incidence of variables such as <u>minifundismo</u>, isolation and subsistence farming.

Reflexive controls allowing for the identification of net project effects would be possible in the longitudinal investigation. The possibility arises from the fact that the CTTA methodology calls for changes in the treatment, if they are believed to be necessary, and that repeated treatments to reinforce effects are not only possible but likely to occur. That is, communication strategies may be modified as a result of experience. Modifications introduced may help tune-up interventions to increase the possibility of impact. Consequently, treatments may not be firmly designed and constant throughout the project's life. On the other hand, communication strategies may be repeated over time as messages regarding bean cultivation, for example, may be presented in a number of cropping

seasons. As it will be explained in further detail in Section C.1 dealing with the research design, the longitudinal investigation will resemble a panel study in that several measurements to determine impact will be carried out during the intervention. Such repeated measurements, taken of the same subjects, will allow us to isolate the net effect of either variations in the treatment or the repetition of invariable treatments acting to reinforce previous learning. Since the qualitative changes in message content and the quantitative changes in message presentation would be targeting the same audiences, subjects could function as their own controls.

An important limitation of using reflexive controls in our case, however, is that they would not allow us to identify and isolate the influence of both secular trends and interfering events. That is, impact measurements would reflect the influence of the treatment, modified or repeated, confounded with that of other phenomena characteristic of Honduras agriculture during the period of project implementation. Those phenomena could be related to long-term trends present in Honduran agriculture such as the progressive integration of Honduran farmers to the market economy which, as we have expressed before, may influence openness toward technological innovation. They could also be related to short-term trends or sudden events occurring only once such as a drought or abrupt changes in Honduran or world market prices for basic grains. The limitations of reflexive controls may be overcome through statistical controls.

The use of statistical controls in the longitudinal investigation may be possible as a result, once again, of project related factors. In this case, we are talking about the project implementation strategy that has been adopted to date and which is likely to be maintained for the long run. At present, that strategy is based on a progressive approach. Although such approach will be mainly valid with respect to the geographical areas where the project will be implemented, it may also be valid with respect to the messages to be diffused. During the first year of implementation, for example, technology transfer activities will be concentrated only in three of the ten extension agencies that exist in the Comayagua Region. During the second year of project implementation, such activities will be expanded to at least two additional agencies. At present, it is possible to anticipate that full regional coverage of technological transfer activities may not take place but until year three. In addition, technologies to be disseminated per agency through the project's communication strategies may be introduced in phases. That is, bean related technologies may be introduced first and corn relates technologies may be introduced second. As a result of this approach, treatments may have relative limited coverage during at least half of the project's life. If the sample for the longitudinal investigation were to be selected from all (similar) extension agencies in Comayagua, farmers living in areas to be

affected by the project until the out years of project implementation could function as controls. This would be possible because they would be farmers that the project has not yet reached and from which treatment would be, fully or partially, temporarily withheld. They could function as statistical controls since farmers in later affected agencies could be matched with farmers in earlier affected agencies in variables believed to be important

to isolate net project effects. Farmers in both types of agencies, those affected by later or earlier interventions, would receive the influence of secular trends and intervening events. As a result, the limitations of reflexive controls would have been resolved.

Despite the advantages of statistical controls over reflexive controls, the second option has its own peculiar disadvantages. It is an option that has validity for partial coverage interventions, but not for those that suppose full coverage of a given population. In addition, it is directly dependent on the project's implementation strategy. In other words, since project activities will be eventually carried out throughout Comayagua, farmers in later affected agencies could serve only as temporary controls. On the other hand, project implementation activities may be speeded up and at a much more rapid pace than can be presently anticipated. Thus, perhaps reducing the duration of treatment withholding so much as to make the possibility of sufficiently large temporary statistical controls practically unfeasible. An option that would overcome these difficulties is that of working with a constructed control group. This would be formed by farmers in similar conditions to those in Comayagua. That is, practicing hillside or flat land agriculture, with limited access to technical and credit assistance, yet with access to regional or national markets. They could be selected from another area in the country such as Talanga in Central Honduras or Quimistan in Western Honduras, characterized by the absence of treatments throughout the duration of the project's life.

The decision regarding what type of control is to be used is still to be made. Nevertheless, there is a preference for either statistical or constructed controls. The final selection will be linked to cost implications. As a result of available funds, the project may have to settle for a less than perfect evaluation. "Perfection" is here associated with constructed control groups.

C. Do we need to Focus on Certain Crops or Technology?

In Honduras, the project will disseminate technologies related to different crops. These crops are either basic grains or vegetables. Basic grains include corn, beans and rice. Vegetables include, but are not limited to: tomatoes, cabbage, potatoes and cucumbers. In addition, messages will be disseminated on soil conservation, and the project may be

confronted with the need to disseminate messages on water management. In other words, technology transfer activities may include seven crops and two natural resources management practices.

Following up project impact in all of these activities may prove to be a very expensive exercise. Financial limitations require that the longitudinal investigation focuses on some crops and natural resources technologies. On possible option is to concentrate on basic grains. Another is to collect data only on one crop or technology per possible category: basic grains, vegetables or natural resources management. Although this decision is yet to be made, the budget presented in Section D assumes that impact data will be gathered on a maximum of 4 technology dissemination activities.

2. Identification of the Model

In order to understand the role of the project in the total context of agricultural technology development and transfer, it is necessary to locate it in the total agricultural knowledge generation and dissemination scenario. As indicated above, this scenario is known as the agricultural knowledge system. It includes the linkages and inter-dependence between research, extension and the farmer. Recognition of this inter-dependence and working within such a framework is crucial for the development of technology that takes into consideration the farmers' socio-economic, physical and institutional circumstances.

One of the models that have been used to illustrate these relationships among research, extension and the farmer is that of Lionberger, presented in Fig. I (Diagram to be explained).

In this model, this project would be located in either the research subsystem, or in the extension subsystem, or somewhere between the research and extension subsystems. Whereas in Peru it is located in the research subsystem, in Honduras it is located between the research and extension subsystems. When located between the research and the extension subsystems it has the possibility of performing a linking role between them. In addition, it may have another role: that of communication research and information identification, packaging and dissemination.

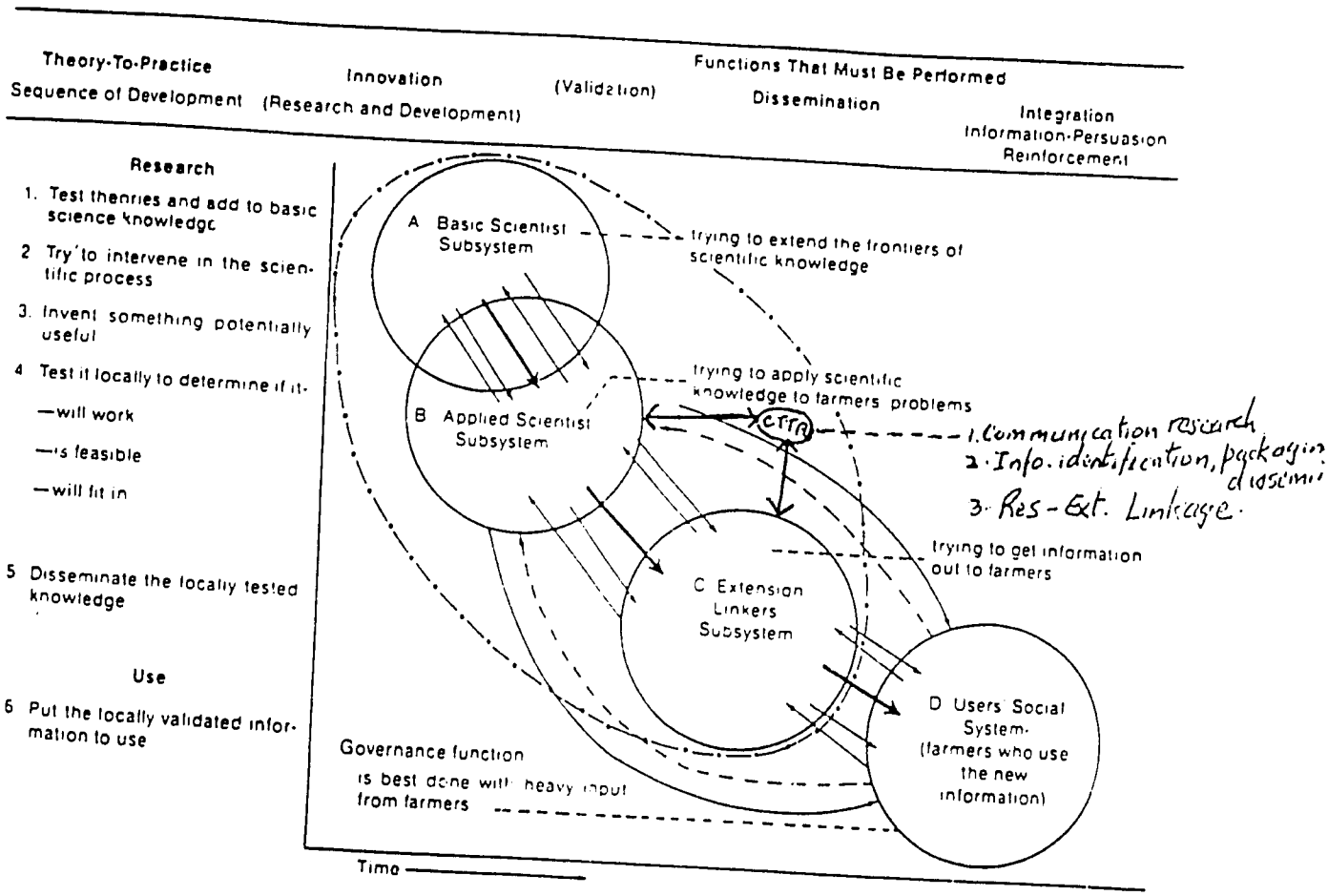

Fig. 1: A knowledge generation-dissemination-utilization system.

Beyond the location of the project in the overall technology development - dissemination picture, it is necessary to understand the environment in which it operates and the factors that are related to and may influence its functions.

Basically, the ultimate objective of the project istoincrease the use of available appropriate technology. The intermediate objectives are development and verification of a communication strategy/ methodology. Achieving the ultimate objective would be test of the communication strategy itself. However, absence of impressive achievements should not be an indictment on the communication strategy since communication is but only one factor

in the system and all other factors are assumed to be present and operating efficiently. This assumption may prove to be the most important deciding factor in the achievement of the ultimate objective.

It should be remembered that communication does not insure change. "Communication is never a sufficient condition for bringing about change by itself... The other variables must be reckoned with. Some ultimately can be changed and some you will have to live with" (Lionberger, 1982 p.7.).

What are these other variables in reality? One of the several lineal model that identifies the variables that affect changes in farmer use of technology is that of Lionberger. This model is presented in Fig. 2.

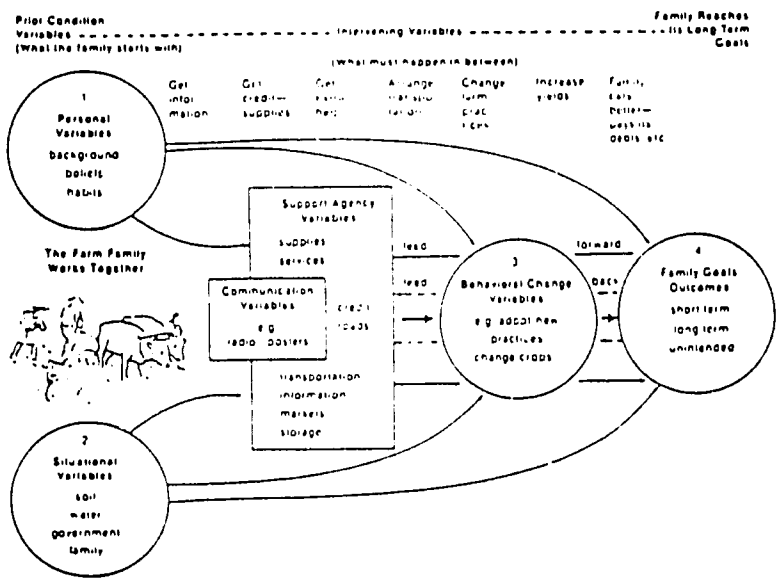

Fig. 2 : Variables and their relationships in the agricultural change process.

Lionberg (1982) suggests that the variables that have to be taken into consideration can be categorized as follows:

1. Personal Variables: age, literacy, sex, management ability, beliefs, habits (tradition).

2. Situational Variables:

   a. Physical resources: land size, soil type,

irrigation, topography, climate.

b. Social groups: family, friendship, religious, special interest, locality, etc.

c. Belief system: what a person believes mostly as a result of past experience, socialization, traditions and customs often determines his behavior.

3. Institutional Support Variables: supplies services, credit, storage processing, marketing, transportation, roads, extension service; research (technology development).

4. Communication Variables: radio, written material, personal contacts, clarity and relevance of information, etc.; availability of appropriate technology to disseminate.

3. Operationalization of the Model

a. Change Process to be Identified

Each of these variables is important for the farmer when trying to decide on the use of an innovation (new technology being recommended). This decision making process is sometimes called the adoption process which very simply consists of the following stages:

1. Awareness = Becoming aware of the innovation as a result of information disseminated by radio; written material or other forms of contact.

2. Knowledge = Becoming informed on the innovation. As a result of interest developed after becoming aware, a farmer may seek further knowledge or clarification from friends, family or other persons knowledgeable (e.g. extension).

3. Evaluation = Mental evaluation of what he has heard or seen about the evaluation and deciding on its utility and applicability in his specific circumstances after considering situational and after factor.

4. Trial = If he is satisfied that under his circumstances not too much risk is

involved, he may decide to try the innovation on a part of his plot.

5. Adoption = If he is satisfied with the results, and all other factors taken in consideration remain constant, he may continue to use the innovation. If unsatisfied he would discontinue to use it.

This process may take from a few weeks to several years dependent on the interplay of the variables listed above and the characteristics of the innovation itself.

b. Variables Explaining Change Process in Honduras

For this evaluation, the variables involved in the change process are organized in a model to show causal relationships. This model is presented in Fig. 3.

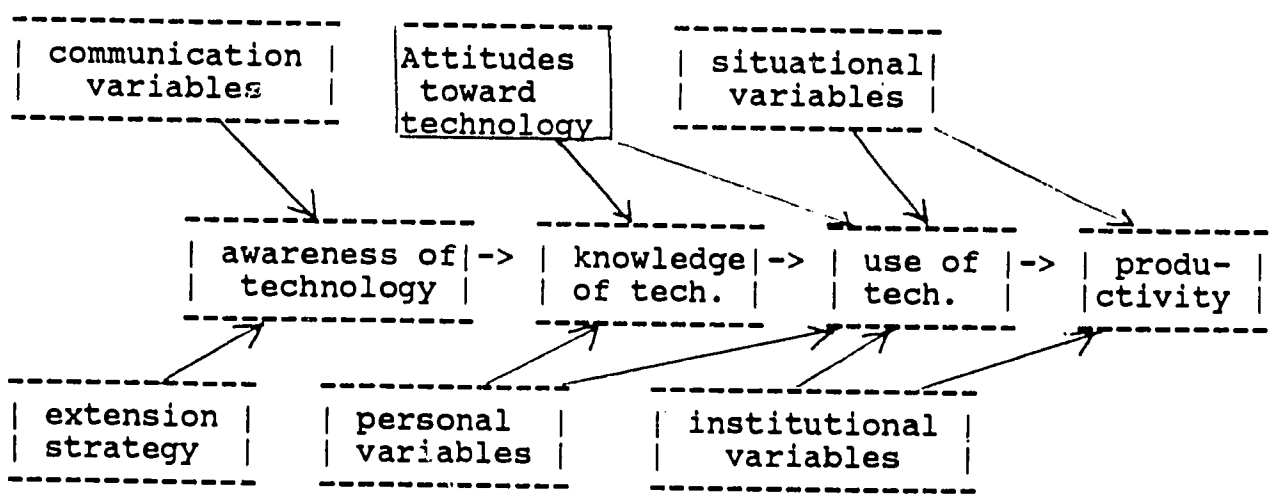

Fig. 3 : Variables of the change process in a causal relationship.
(Model to be explained further)

c. Research Questions Resulting from Model

Arising from this model are the following research questions and corresponding hypotheses which are the main focus of this summative evaluation.

1. Can improvements in communication strategy for the transfer of agricultural technology, without accompanying changes in situational and institutional factors, produce increase use of available technology. Alternatively, what effects can an improved communication strategy have on the awareness, interest,

trial and adoption stages of the farmer?

2. What are the characteristics of specific technology or parts of technology that can be successfully transferred with CTTA's approach?

3. What other factors affect the successful transfer of agricultural technology when using the CTTA's approach?

4. Is improvement in farmers' knowledge of the technology being transferred correlated with farmers' use of the technology? What percentage of the variance in farmers' use of the technology is explained by farmers' knowledge of the technology? What other factors explain variance in farmers' use of technology?

5. Is use of technology correlated with increase in productivity? What percentage of the variance in productivity is explained by use of technology? What other factors explain variance in productivity?

6. What is the impact of increased productivity and production marketability on technology use?

d. Resulting Hypotheses

The general hypothesis is that an improved communication strategy using mass media, working in association with agricultural extension for the transfer of agricultural technology, will produce significant increase in the use of the technology being transferred and consequential increase in productivity. There are several specific hypotheses related to this general hypothesis:

1. (Positive) : The improved communication strategy will produce significant increase in farmers' awareness of technology being transferred.
   (Null) : There will be no significant increase in farmers' awareness of technology being transferred.
2. (Positive) : Farmers knowledge of technology being transferred will increase significantly. Awareness of technology being transferred will significantly correlate with knowledge of the technology.
   (Null) : There will be no significant increase in farmers' knowledge of technology being transferred. There will be no correlation awareness and knowledge of technology.
3. (Positive) : There will be a significant increase in the use of the technology being transferred. Knowledge of technology will significantly correlate with use of technology.
   (Null) : There will not be any significant increase in use of technology being transferred. There will not be any correlation between knowledge of technology and use of

technology.

4. (Positive) : There will be significant increase in the productivity of farms as a result of the use of technology being transferred. Use of technology will be significantly correlated with increase in productivity.
(Null) : There will be no significant increase in productivity of farms. Use of technology will not be correlated with increase in productivity.

5. (Positive): There will be significant continued adoption of disseminated technologies both when farmers obtain higher productivity and are able to adequately place additional production on the market.
(Null): Higher productivity and adequate placement of additional production on the market will have no significant impact on continued adoption of disseminated technologies.

e. <u>List of Variables in the Summative Evaluation</u>

In the summative evaluation of this project it is necessary not only to measure the use and continued use of an innovation but also to measure progress in the adoption process of the farmer, especially increase in awareness and improvement in knowledge of the innovations (becoming more informed) and reasons for rejection at any stage in the process.

In addition, all other variables that affect the change process one way or the other should be measured, monitored and used as control variables. With these considerations the following is an outline of variables to be used in this evaluation.

A. <u>Independent Variables</u>

1. Participation in CTTA mass-media activities during the last cropping season.
   a. Radio
   b. Printed Materials

2. Institutions providing technical assistance during the last cropping season.
   a. Public Sector Institutions (e.g., MNR, BANADESA)
   b. Private Sector Institutions (e.g., PVOs, coops)

3. Types and frequency of activities in which farmer participated last cropping season.
   a. Public Sector Institutions (e.g., MNR, BANADESA)
      i. Individual vs. group activities
      ii. Strictly pedagogical vs. pedagogical combined with entertainment
   b. Private Sector Institutions (e.g., PVOs, coops)
      i. Individual vs. group activities

ii. Strictly pedagogical vs. pedagogical combined with entertainment

B. Control Variables

1. Farmer's Individual Characteristics
   a. Age
   b. Sex
   c. Family Composition
   d. Level of Instruction
   e. Access to literate persons inside or outside household
   f. Disposition to risk
   g. Perceived need for technical assistance and agricultural knowledge
   h. Radio/TV use
      i. Ownership of media equipment
      ii. Listening hours
      iii. Preferred programs
   i. Perceived benefits of extension and educational activities
      i. Clarity
      ii. Utility
   j. Perceived benefits of technologies adopted as a result of CTTA activities
   h. Attitude toward technology
2. Farmer's Means of Production
   a. Number and sizes of plots cultivated last cropping season
   b. Characteristics of plots utilized
      i. Tenancy
      ii. Slope
      iii. Fertility
      iv. Access to irrigation
      v. Access to roads
   c. Land Use
      i. Type of crops per plot during last cropping season
      ii. Type and amount of fallow land

3. Access to (Institutional) Services
   a. Credit
      i. Sources
         -Informal
         -Formal
      ii. Characteristics of system
         -Requirements
         -Conditions
         -Efficiency (e.g., timely availability)
      iii. Uses
         -Crops
         -Commodities and services

iv. Repayment experience

b. Inputs
   i. Sources
   ii. Efficiency of service
   iii. Training offered by providers

c. Marketing
   i. Production proportions sold
   ii. Time of sale
   iii. Degree of processing when sold
   iv. Buyers
   v. Perceived marketing difficulties

C. <u>Dependent Variables</u>

1. Knowledge of Recommendations Per Crop (e.g., Corn, Beans, Rice)

a. Soil Preparation
   i. Cleaning
   ii. Plowing System
      -Period
      -Frequency
      -Depthness
   iii. Inputs Utilized

b. Seed Selection Either Purchased or Not
   i. Variety
   ii. Selection Criteria

c. Seed Disinfection
   i. Product(s)
   ii. Dosage

d. Planting
   i. System
   ii. Distances
   iii. Number of Seeds
   iv. Depthness

e. Fertilizer
   i. Type(s)
   ii. Period(s) of application
   iii. Frequency of application
   iv. Quantity applied

f. Hilling of Soil ("<u>Aporque</u>")
   i. Type
      -Manual
      -Mechanical
   ii. Period

iii. Frequency
iv. Combination with other practices

g. Weeding
i. Type of weeds
ii. Control system
iii. Technology
-Manual
-Chemical
iv. Period
v. Frequency
vi. Amounts utilized if chemicals proposed
vii. Combinations with other practices

h. Pest Prevention and Control
i. Types of pests
ii. Prevention and control system
iii. Inputs utilized
iv. Period
v. Frequency
vi. Quantity
vii. Combination with other practices

i. Disease Prevention and Control
i. Types of diseases
ii. Prevention and control system
iii. Inputs utilized
iv. Period
v. Frequency
vi. Quantity
vii. Combination with other practices

j. Harvest
i. Criteria for determining maturity
ii. Harvesting system

k. Storage
i. Quantity stored
ii. System of storage
iii. Treatment of stored production

2. Practice of Recommendations Per Crop (e.g., Corn, Beans, Rice)

a. Soil Preparation
i. Cleaning
ii. Plowing System
-Period
-Frequency
-Depthness
iii. Inputs Utilized

b. Seed Selection Either Purchased or Not
   i. Variety
   ii. Selection Criteria

c. Seed Disinfection
   i. Product(s)
   ii. Dosage

d. Planting
   i. System
   ii. Distances
   iii. Number of Seeds
   iv. Depthness

e. Fertilizer
   i. Type(s)
   ii. Period(s) of application
   iii. Frequency of application
   iv. Quantity applied

f. Hilling of Soil ("Aporque")
   i. Type
      -Manual
      -Mechanical
   ii. Period
   iii. Frequency
   iv. Combination with other practices

g. Weeding
   i. Type of weeds
   ii. Control system
   iii. Technology
      -Manual
      -Chemical
   iv. Period
   v. Frequency
   vi. Amounts utilized if chemicals proposed
   vii. Combinations with other practices

h. Pest Prevention and Control
   i. Types of pests
   ii. Prevention and control system
   iii. Inputs utilized
   iv. Period
   v. Frequency
   vi. Quantity
   vii. Combination with other practices

i. Disease Prevention and Control
   i. Types of diseases
   ii. Prevention and control system
   iii. Inputs utilized

iv. Period
v. Frequency
vi. Quantity
vii. Combination with other practices

j. Harvest
i. Criteria for determining maturity
ii. Harvesting system

k. Storage
i. Quantity stored
ii. System of storage
iii. Treatment of stored production

3. Knowledge of Soil Conservation Practices

4. Use of Soil Conservation Practices

5. Yields Per Crop and Plot

C. THE LONGITUDINAL INVESTIGATION: METHODOLOGY

1. Research Design

a. Validity

The most important consideration in an evaluation (research) design is insuring that internal and external validity of the results will take place. Validity is considered as referring to the technical soundness of a study.

"Internal validity is the basic minimum without which any experiment is uninterpretable: Did in fact the experimental treatments make a difference in the specific experimental instance?" (Campbell and Stanley, 1963; p.5). An evaluation or research that is internally valid is characterized by having successfully controlled (or accounted for) all systematic influences between the groups being studied.

"External validity asks the question of generalizability. To what populations, settings, treatment variables and measurement variables can this effect be generalized? (Campbell an Stanley, 1963; p.5.). The following are some considerations for external validity: "Is the sample sufficiently representative that the researcher can actually say something about the population being studied? How well do the results of a given investigation represent the questions being asked? How well do the results of a given investigation represent or apply in terms of the population that is ostensibly being studied and the real world environment in which this population resides?" (Drew, 19__; p.138).

In order to insure internal and external validity, it is necessary to understand how certain factors operate against this insurance. The enumeration of these factors follows.

b. Factors Affecting Internal Validity

1. History: Any programs, policy, event other than the treatment occurring between the first and second measurement that can have and effect on the dependent variable(s).

2. Maturation: All biological on psychological processes which systematically vary with the passage of time. That is growing older, hungrier, tired, bored, more experienced in the particular area being studied, etc.

3. Testing: The effect of the first testing on the responses obtained in the second testing. People tend to become more learned and experienced in answering the same questions.

4. Instrumentation: Changes in instrument, calibration of measuring instrument or changes in interviewer who may code differently may produce differences in the obtained measurement.

5. Selection: Biases in the selection of respondents. For example, selecting from among groups that are more knowledgeable or in receipt of higher level of services than normal will produce better than normal results.

6. Mortality: Changes in the composition of the respondent group. Replacing respondents who dropped out, with persons somewhat different from those who dropped out, can affect subsequent measurements.

c. Factors Affecting External Validity

1. Interaction of testing and the treatment. This is the phenomenon in which the pretest increases or decreases the respondent's sensitivity or responsiveness to the experimental variable and thus make the results obtained for a pretested population unrepresentative of the effects of the experimental variable for the unpretested universe from which the experimental respondents were selected.

2. Interaction of selection and treatment. When there are characteristics in the test group that can cause the experiment or treatment to be more effective than it would be in the target population.

d. The Design Being Used

The importance of internal and external validity dictates that designs strong in insuring these characteristics be selected unless situations being studied precludes use of such designs. The best design for this evaluation would probably be a modification of the Pretest-Posttest Control Group Design (Campbell and Stanley, 1963; p. 13-22) that would permit repeated measures of the treatment and control groups. This is illustrated as follows :

(Experimental Group) $R\ O_1\ X\ O_3\ X\ O_5\ X\ O_7\ X\ O_9\ X\ O_{11}$

(Control Group) $R\ O_2\ X\ O_4\ X\ O_6\ X\ O_8\ X\ O_9\ X\ O_{12}$

The respondents in the experimental and control groups are randomly selected (indicated by R). O_1 and O_2 are the pretests on the two groups and O_3 and O_4 the posttests. Only the experimental group receives the treatment (X). The differences in gain scores between the experimental and the control group would be attributed

to the treatment. A similar determination would be made for O_5 and O_6 the posttest scores for O_3 and O_4, and so on. Such a design would control for almost all rival hypotheses that affect internal and external validity.

However, for this project the availability of an equivalent control group within reasonable access is difficult and use of a control group outside of the region may be considered too costly. The next best alternative would be to use a non-equivalent control group and a modification of the non-equivalent control group design to facilitate repeated measures of the same subjects in the treatment and 'control' group over a period of four years. This approach is also called a panel study. For a more detailed discussion of options for the longitudinal investigation refer to Section B 16 above.

The addition of even an unmatched or non-equivalent control group reduces greatly the attribution of effects to rival hypotheses. Assuming that the treatment and 'control' group are almost similar but not equivalent, this design may be considered as 'controlling' for history, maturation, testing and instrumentation between the pretest and posttest. External validity problems such as selection and interaction effects may also be regarded as being 'controlled'. (To discuss further the type of control group that will be used after a decision is made).

2. Sampling

a. Sample Size

The question of what size sample is needed is most difficult to answer because there is no set sample size for all conditions. A primary concern is that an adequate sample be obtained.

Certain characteristics of the population have a great deal to do with how large the sample must be to accurately predict population factors. If a population is homogenous (i.e. little variation in the population), then a smaller sample will suffice than if more variation is present. Variance therefore is an important characteristic in determining sample size. However, population variance is often unknown. Some indications may be obtained from previous research on the population in question or a similar population if such research has in fact been conducted.

In addition to knowing the variance (or standard deviation), it is also required to know what standard error of the mean the researcher would like to live with. Initially this requires a knowledge of the population mean which also is often unknown.

If one knows the standard deviation of a variable, the population mean and tolerable standard error of the mean, it is possible to use the following formula to calculate sample size.

$$1.96 \times \frac{S}{\sqrt{N}} = X \quad \text{for 0.05 level of significance}$$

and $$2.58 \times \frac{S}{\sqrt{N}} = X \quad \text{for 0.01 level of significance}$$

S = standard duration

X = error of the mean one can tolerate

N = sample size

However, this is only for one variable and often many more variables of vastly different standard deviations and means are under investigation at the same time.

A good guide in determining sample size is to ensure that at least a certain minimum of subjects is available for each cell whenever the group is to be divided into sub-groups or categories for analysis. An accepted minimum per cell for most purposes is 30.

Another guide may be obtained from past national and regional studies. In general, national surveys use samples of 1000 or more, whereas regional surveys vary considerably from 50 to 1000 or more depending on the size of the region.

For this evaluation, the yield statistics for corn for period 1975 to 1983 was used to obtain an estimate of the sample size that would be needed. Using a calculated standard deviation of 600 and a standard error of the mean of 50 (the calculated mean is 1200) in the above formula, a sample size of 576 was obtained. Because the figures for the calculation of the standard deviation may contain errors, it was decided to use 700 as a more conservative estimate of this value. This gives a sample size of 784. Rounding this figure a sample size of 800 will be used. These will be selected from the five agencies in accordance with population distribution among the agencies.

Experimental Agencies:

		Approx. distribution	
Present:	1. San Luis	160	
	2. San Jeronimo	160	
Future:	3. Villa de San Antonio	160	
	4. To be identified	160	
	5. To be identified	160	800
Control Agency:	6. To be identified	200	200
			1000

b. Sampling Methodology

i. Sampling Frame

As part of the activities of the AID-funded Small Farmer Titling Project, all farms in the Department of Comayagua were cadastered in 1985. The purpose of carrying out this activity was to identify farmers eligible for obtaining fee simple titles for the farms that they cultivate. An important eligibility criterion for farmers under 5 has. is the cultivation of coffee.

Information existing in orthophotos taken of the Department of Comayagua during the mid- and late 70s were verified and updated in the field. Cadastre field teams combed the whole department in order to create cadastre files for each one of the farms in the department. These files contain information such as the name and address of land holders and the size, tenancy status and land uses of holdings. Using this type of information, cadastral maps have been constructed. The maps include farms, with necessary identification variables, and physical features such as roads and rivers. Areas occupied by human settlements are also identified.

To complement cadastral information, data on soil characteristics was also obtained. These data reflect the physical characteristics of the soil including slope, texture, fertility and depthness. Information on the characteristics was obtained at the semi-detail level. Based on the number of possible alternatives and combinations thereof, a soil typology was constructed. This typology includes 10 different categories of soils. Category I refers to the best agricultural lands. Category X, on the contrary, refers to the best pine forest lands. Maps showing soil characteristics based on this typology are available.

The project's objective is to change the farmer's agricultural knowledge and practices. In Honduras, the implementing agency has decided to concentrate its activities on farmers cultivating annual crops. As a result, the unit of analysis for the longitudinal investigation is the farmer. And the farmer dedicated to annual crop cultivation.

The data base generated by the cadastre activities in the Department of Comayagua is of high value for the longitudinal investigation. Due to the availability of information on soil characteristics, it would be possible to construct strata reflecting soil variations. These strata would be constructed integrating categories of the already developed soil typology. The integration of categories would be done in a way relevant to our research, allowing us to control for some of the situational variables outlined in Section B.3.c describing the longitudinal

investigation's model. In addition, because we would have access to the list of all farmers in the department, we could select those which are of interest of us: annual crop cultivators. We would be able to identify annual crop cultivators in each one of the strata, and from there be able to select our sample.

There are strong reasons to believe that the cadastre generated data are reliable. First, corrected orthophotos had to show all possible uses of the land areas that they included. That is, areas destined to farming, industry, human settlements, and/or virgin. As a result, all farm holding in the department had to and were identified. Proper supervision insured that the job was done properly. Second, it was in the farmers, interest to report all holdings. If this was not done, it would not be possible for them to obtain titles for those holdings and then claim ownership.

The procedure to be followed in the selection of our sample, using the cadastral data base, will be described below.

ii. Sampling Procedure

The longitudinal investigation will be carried out in a selected number of extension agencies in the Comayagua Region. The maximum number of agencies where research activities will be carried out is five. Agency selection will be associated with the project's implementation strategy. As indicated before, during year 1 of project implementation communication strategies will be implemented in 3 agencies. During year 2, project activities will be expanded to at least 2 more. By year 3, project activities could be covering all of the region. Based on this strategy, research activities for the longitudinal investigation will be carried out in 2 of the agencies of project focus during year 1; in 1 of the agencies of expanded project coverage in year 2; and in 2 of the agencies of expanded project coverage in year 3+. The following table summarizes these linkages between the project implementation strategy and the longitudinal investigation.

Project Implementation Years	Agencies of Project Coverage	Agencies to be Selected for Longitudinal Investigation
Year 1	3 Agencies	2 Agencies
Year 2	+2 Agencies	1 Agency
Year 3+	+5 Agencies	2 Agencies
End of Project	10 Agencies	5 Agencies

Agencies where data will be collected will be selected on

purpose. Preference will be given to agencies characterized by their heterogeneity. In our selection, we will be concerned with heterogeneity between agencies as well as with heterogeneity within agencies. Criteria for determining heterogeneity will include, but no be limited to: presence of hillside and flatland cultivation; presence of irrigated and non-irrigated farms; presence of both market-oriented and subsistence farming; presence of individual vs. collective farming; and presence of individual vs. collective farming.

Once the agencies where the investigation will be conducted have been selected, their soil characteristics and farming population density will be utilized to construct sampling strata. The farming population density that we are interested in here is that of basic grain growers. By superimposing the maps of soil types on the maps of plots it is possible to categorize the maps into at the most six strata. These categories would be arrived at on the basis of whether there exists high density or low density of plots and on the prevailing soil types. As suggested above, the existing soil topology will be reduced from ten categories to three. Types 1 through 3 will constitute Stratum A; types 1 through 4 will constitute Stratum B; and types 8 through 10 will constitute Stratum C. When crossing soil characteristics by farming population density, utilizing the variable values indicated above, we would construct the following two-entry table reflecting the existence of six strata.

DENSITY OF PLOTS.	SOIL TYPES		
	A	B	C
HIGH DENSITY			
LOW DENSITY			

We will determine the number of annual-crop-producing farms that exist in each one of the maps corresponding to the cells in the table above. As a second step, we will determine who are the users of those farms in order to control for multiple farm use per farmer, an important characteristic in the area detected by previous studies. The identification of farm users will allow us to identify the population of farmers from which our sample will be drawn.

Farmer listings per map provided by the Executive Cadastre Directorate will be of use here. Since these listings are likely to show for most municipios in Comayagua farmers holding ejido and national lands, the listings will be complemented with information from existing raw data files which include data on privately owned holdings. Again, privately owned holdings to be taken into account will be those where annual crops are cultivated. Corrections for multiple farm ownership will also be carried out.

The number of farmers to be selected per cell will reflect the population proportions. The selection of farmers per cell will be done randomly.

D. BUDGET	YEAR 1	YEAR 2	YEAR 3	YEAR 4
Salaries				
Research Supervisors				
(3 persons x 3 months x $450/month)	$ 4050	4050	4050	4050
Interviewers				
(11 persons x 3 months x $350/month)	$ 11550	11550	11550	11550
Driver				
(1 person x 13 months x $300/month)	$ 3900	3900	3900	3900
Sub-Total	$ 19500	19500	19500	19500
Per Diem				
Evaluation Field Director				
(1 person x 90 days x $35/day)	$ 3150	3150	3150	3150
Research Supervisors				
(3 persons x 34 days x $15/day)	$ 1530	1530	1530	1530
Interviewers				
(11 persons x 34 days x $15/day)	$ 5610	5610	5610	5610
Driver				
(1 person x 60 days x $15/day)	$ 900	900	900	900
Sub-Total	$ 11190	11190	11190	11190
Transportation Costs				
Vehicle Rental				
(2 x 2 months x $1250/month)	$ 5000	5000	5000	5000
Gasoline				
(40,000 kms. x $0.05/km.)	$ 2000	2000	2000	
Project's Vehicle Maintenance	$ 1000	2000	2000	[illegible]
Sub-Total	$ 8000	9000	9000	9000
Data Entry and Verification				
(1000 interviews x 2 x $2/interview)	$ 4000	4000	4000	4000
Secretarial Services	$ 6500	6500	6500	6500
Office Supplies				
Reproduction of Questionnaires	$ 500	500	500	500
Photocopies	$ 500	500	500	500
Other Supplies	$ 500	500	500	500
Sub-Total	$ 1500	1500	1500	1500
Communication with Main Office				
Postal Expenditures	$ 400	400	400	400
Telephone Communications	$ 2000	2000	2000	2000
Sub-Total	$ 2400	2400	2400	2400
Miscellaneous	$ 2000	2000	2000	2000
Contingency	$ 2000	2000	2000	2000
Total	$ 57090	58090	58090	58090

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E. CALENDAR OF ACTIVITIES

	Year 1				Year 2				Year 3				Year 4			
	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4
	M J J	A S O	N D J	F M A	M J J	A S O	N D J	F M A	M J J	A S O	N D J	F M A	M J J	A S O	N D J	F M A
- Preparation of Design of Longitudinal Investigation	x x															
- Questionnaire Design and Testing	x															
- Selection of Sample	x															
- Selection, Hiring and Training of Interviewers	x															
- Logistical Preparation of Data Collection		x														
- First Round Data Collection		x x														
- Data Entry		x														
- Data Analysis		x	x													
- Preparation of Report			x													
- Rehiring and Reinforcement Training of Interviewers			x													
- Second Round Data Collection First Year			x	x												
- Data Entry				x												
- Data Analysis				x x												
- Preparation of Report				x												

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