

Richard La Valley and James Ray, U.S. Bureau of the Census
 Emerita C. Villanueva, National Electrification Administration, Philippines

Introduction

The rural electrification program began in the Philippines in 1965 with the fielding of a team from the National Rural Electric Cooperative Association (NRECA) to conduct a feasibility study of two pilot rural electric cooperatives. The success of these cooperatives led to the establishment in 1972 of a full program to electrify rural areas of the Philippines. [1] By the end of 1977, electrical connections exceeded 700,000 households in 62 cooperatives. Planning for evaluation of the institutional and socioeconomic aspects of the project began in late 1974 with the Census Bureau's involvement in evaluation planning beginning in September 1975.

A major problem in conducting evaluations in developing countries is institutionalization or development of evaluation capabilities in the host agency or the agency responsible for the project. Institutionalization, in this instance, means the establishment of an ongoing organization within the host agency which would have the capability for conducting sound evaluations. It is nearly impossible to find experienced statisticians with general survey and evaluation experience and to find management that fully appreciated the value of probability surveys in a host government agency. This is a continuing problem in the United States and no less a problem in the Philippines. Therefore, the first task of this project was to develop a capability for all phases of evaluation within the National Electrification Administration [NEA].

Evaluation can be conducted on various parts of a project. The group responsible for implementation of a project normally develops a management information system in conjunction with their accounting system for evaluating the implementation. The long-range impact of a project requires additional information gathered over a longer period of time in accordance with requirements of an impact evaluation plan. This plan usually specifies the type of experimental design, the type and scope of surveys, the timing of data collection and other salient features of the impact evaluation study.

The purpose of an impact evaluation is to determine the effect of the experimental variable on project goals by careful appraisal and study of the change in value of key variables. The variables are selected because they constitute either a direct measurement of progress against a predetermined goal or they serve as an acceptable proxy for direct measurement. Project goals provide the stated reasons for conducting a project. In this it is presumed that the project outputs will initiate forces - social, economic and political forces - that will eventually produce the long-range effects envisioned by the project planners.

The importance of this type of evaluation can be appreciated more if one considers the limitation of resources that are available to developing countries and the hard choices which must be made in selecting development projects. Information on the impact of these projects provides objectivity to the selection process with the ultimate

goal of the evaluation being to enable developing countries to get the most for their development dollar.

However, a recent study of rural electrification projects in seven countries encompassing 20 AID projects concluded that the existing documentation on rural electrification projects is wholly inadequate for analyzing project effectiveness. [2] Probably the largest single factor contributing to this lack of information on the impact of rural electrification in developing countries is the absence of the institutional capability to conduct an evaluation. In those projects, this made it difficult for evaluation planning and implementation to be carried out properly. In recognition of that problem, the primary goal in the Philippines was to develop the institutional capability in the NEA to conduct major impact evaluations. The NEA established the organization and provided staff for this purpose within the Directorate for Franchises and Regulation of Cooperatives. The U.S. AID Mission in Manila, through consultants from the U.S. Bureau of the Census, provided technical assistance and consultation.

This paper presents certain parts of the impact evaluation including the statistical design, the overall analytical plan, and sampling considerations which are being used for evaluation of introduction of rural electrification in the Philippines. The focus is on the revision to the overall evaluation plan and the design for the second nationwide survey.

In preparing the design for the second nationwide survey, NEA found it necessary to revise the original evaluation plan by changing some of its goals and their precedence. Primary emphasis in the first nationwide survey, in addition to identifying and describing the beneficiaries of rural electrification, was on evaluating the institutional capability of NEA in providing service to rural poor as compared to utilities who were not organized as cooperatives. This was accomplished by comparing cooperatives with privately franchised utilities. For the second survey, NEA wanted to place more emphasis on the impact of electrification on the rural poor and business establishments.

The NEA had planned a separate survey of business establishments. To thoroughly evaluate the impact of rural electrification, analytical requirements dictated that the evaluation of the effect of electrification on business establishments be combined with the nationwide household survey, although the fieldwork and data collection would be done separately from the household survey. Several problems exist though.

The experimental variable, in this case rural electrification, was not introduced randomly into municipalities. In addition, criteria used in selecting municipalities for electrification vary from political consideration to the policy of private utilities being taken over by cooperatives. An added problem is that the selection criteria of these private firms would be difficult to reconstruct. Since the primary objective of this evaluation was to measure the socioeconomic benefits

of rural electrification over time, one approach would be an experiment designed to measure these benefits by comparing electrified and nonelectrified towns that had similar socioeconomic characteristics prior to introduction of the experimental variable or by comparing the socioeconomic characteristics of households before and after electrification. A true experimental design for comparing electrified and nonelectrified towns could not be designed at the time because the experimental variable was not introduced randomly.

A quasi-experimental design could have been attempted, but it would have required matching the sample of nonelectrified towns with electrified towns prior to sampling; even then the sample would not have been representative of the nonelectrified subuniverse. In addition, assumptions would have to have been made that all variables had the same relationship to the other subuniverse as the matched variables.

Because of the problems associated with matching samples, a decision was made to look for an experimental design for the 1980 surveys which did not require matching variables and yet, was compatible with the original 1977 design. [3] The "before-after" design required waiting at least two years until the next survey in order to meet the goal of assessing the benefits of rural electrification. However, by enlarging the nonelectrified sample, some matching of the probability samples of the electrified and nonelectrified subuniverses will be possible after the fact. This matching will be based on available socioeconomic data or income and expenditure data for 1970. These data will predate the introduction of the experimental variable in most provinces. A special cross tabulation will then be made of key socioeconomic variables for matched towns to assess the benefits accruing to the electrified towns. Since current plans call for the entire country being electrified by 1990, the 1980 survey will probably be the last opportunity to conduct a "before-after" design of the nonelectrified towns by collecting information from these towns every 3 years and comparing socioeconomic status of the ones that get electrified with their status prior to electrification.

The rural electrification program in the Philippines provides an unusual opportunity to measure the benefits of electricity over time by making the comparisons previously described. It also compares the socioeconomic status of households with different dates of electrification to determine if length of electrical service improves socioeconomic well-being.

Objectives of the Household Survey

The main purpose of the household survey is to determine the socioeconomic impact of rural electrification on the rural household and measuring the extent to which the experimental variable is extended to the target group or rural household. Other specific objectives are listed below.

To provide a baseline of social and economic data for future research.

To compare the cost of electricity to the consumer in areas served by electric cooperatives with areas served by private utilities and with alternative energy sources.

To compare the social and economic characteristics of households in cooperative areas with households in areas served by private utilities

and areas that do not have electricity.

General Analytical Comparisons and Sample Design Overview

Diagram A and B illustrate several of the comparisons which are of interest. In each diagram, a smaller case letter represents a comparison of interest. In addition, overall profiles of the five areas are to be developed as well as comparisons of these profiles. These are represented by capital letters.

These comparisons represent a first step in the analyses and should not be construed as the only comparisons of interest. Selection of the variables of interest is covered in a subsequent section of this paper.

Sample Design Overview

In accordance with the objectives and the planned comparisons of the household survey, the household universe was partitioned into seven subuniverses. These subuniverses are defined as follows:

In Electrified Towns in Cooperative Areas

Subuniverse 1 (U_1) = Towns served by co-ops energized prior to the 1977 survey (old towns in old co-ops)

Subuniverse 2 (U_2) = Towns served by co-ops energized at the time of the 1977 survey (new towns in old co-ops)

Subuniverse 3 (U_3) = Towns served by co-ops energized after 1977 (new co-ops)

In Noncooperative Areas

Subuniverse 4 (U_4) = Towns served by a private or municipal electric utility

In Nonelectrified Areas

Subuniverse 5 (U_5) = Nonelectrified towns within the geographical domain of an energized Co-op.

Subuniverse 6 (U_6) = Nonelectrified towns within the geographical domain of a registered by non-energized co-op.

Subuniverse 7 (U_7) = Nonelectrified towns in unorganized areas.

These partitions conform to the planned comparisons of the survey results and the sample size was designed to be large enough for linkage between the first and second nationwide household surveys.

Within each subuniverse, a self-weighting sample of households (electrified, nonelectrified, or both) was selected using a multistage procedure. It was attempted to give all electrified households a 1 in 600 chance of being selected and for nonelectrified households a 1 in 1200 chance. The samples for the seven subuniverses will be combined to provide nationwide estimates. Budgetary constraints limited the total sample size to 5000 households for the sample.

Universe for the Business Establishment Survey

The Universe for the business establishment survey consists of all business establishments in the Philippines except those in the municipalities of Metro Manila, Davao, Cebu, Iloilo, and Angeles which are excluded from the households survey. A business establishment is defined as an economic unit which engages in economic activity as a specific location and having permanent assets on its premises during its operations.

The sample for the business establishment survey will use the same selection or a subsample from the municipalities used in the 1980 household survey. Within municipalities, business establishments will be selected from a list which has been stratified by large (10 or more employees)

and small businesses. Any business establishment which has been in operation for less than a year will be classified as a new business so that new businesses can be excluded from parts of the analyses. Business establishments will be classified according to five major classifications: a) agricultural, b) manufacturing, c) services, d) wholesale and retail, and e) other.

Selecting Variables for Measurement

Survey design usually starts with defining the objectives of the survey. Broad general objectives such as measuring the impact of rural electrification on the rural poor must be translated into the specific objectives outlined above. Decisions must then be made on how these objectives will be measured. Such questions as: "Is income a sufficient measurement of the socioeconomic status of rural poor?" must be answered. To facilitate the selection of variables a method used experimentally by the Bureau called "associative chains" was applied. This method starts by listing the inputs to the project. The physical outputs of the project are then itemized. The next step is to examine the effect of each of these outputs. This is followed by anticipating the long-term, behavioral impact of the project.

For example, the output of the project may be 1.5 million connections to households by the date of the second nationwide survey. The cost savings per household was estimated at P142 per household per year over deriving an equivalent amount of light (in lumens) from a kerosene lamp. Electric pump irrigation was estimated to save P0.3 per KWH over diesel powered pumps. An evaluation of the effects of these savings based on established economic theory [4] [5] resulted in the identification of the economic variables impacted by rural electrification.

After all of the variables were identified, tables were developed and reviewed from the standpoint of providing adequate information for measuring the objectives of the project. After a complete set of tables had been developed, the questionnaire was drafted together with the plan for processing the data. Along with the development of the tables, an analytical plan was developed which is described below.

Analytical Plan

The analytical plan consists of a general plan and a detailed list of tables. The analyses will incorporate the data from the first (1977) nationwide survey in addition to the analyses of data from the second (1980) nationwide survey. These data will be combined and used in evaluating change over time resulting from rural electrification.

Cooperative versus Private or Municipal Systems

In keeping with the comparisons made in the first nationwide survey, the analysis will include comparisons of the socioeconomic variables in towns (municipalities) served by private utilities with those served by cooperatives. Comparisons will be made of income level, education attainment, quality of housing, and other socioeconomic characteristics.

In addition, factors bearing on the impact of electrification on the community such as the outreach of electrical service, the number of food producers, the number of poor households, the number of electrified schools and medical facilities will be compared as well as the attitudes of

the consumers and management of the utilities. A detailed description of this comparison can be found in the report: "Nationwide Survey on Socioeconomic Impact of Rural Electrification, February, 1977," published by the National Electrification Administration, Queson City, Philippines in June 1978.

Households in Electrified versus Nonelectrified Towns

In concert with the objectives of this survey, the analysis of the 1980 data will include a comparison of the socioeconomic characteristics of households from municipalities that have no electrification -- cooperative or private. Because the experimental variable, rural electrification was not introduced randomly and because of the uncertainty surrounding the selection of locations for electrification by both cooperative and private utilities, nonelectrified municipalities in the 1980 sample will be matched with electrified municipalities (both cooperative and private) in the 1980 sample on the basis of population data for 1970 and 1975 or other available socioeconomic data and the type of water system serving the town.

Change in population from 1970 to 1975 and population as of 1975 can be used for matching to towns that were electrified subsequent to 1975. Data on population change for matching purposes should precede electrification of the town since it is the change caused by electrification that is being measured by these surveys. It is assumed that a high degree of correlation exists between the indicators of socioeconomic change, population change and family income.

In addition to the comparison of socioeconomic variables from matched towns, an analysis of the relationship between income, and several variables will be conducted. The variables of interest are:

- Basic need expenditures
- Educational attainment
- House and lot ownership
- Type of home construction
- Number of household items
- Type of household water system
- Employment status
- Total cost of all energy consumed
- Electrification status (within and between areas)
- Subuniverse

With the geographic coding in the data file, the file can be sorted by municipality. Total income can be used as the dependent variable. The percentage of each independent characteristic can be used as independent variables. The principal comparisons which will be made to show the socioeconomic benefits of rural electrification will include:

- Cooperative electrified households with households from nonelectrified municipalities (HN-EM)
- Cooperative nonelectrified households with HN-EM
- Total cooperative households with HN-EM
- Noncooperative (private franchise) electrified households with HN-EM
- Noncooperative, nonelectrified households with HN-EM
- Total noncooperative households with HN-EM
- Total electrified households with HN-EM
- Total households from electrified towns with HN-EM

- Cooperative households with private franchises and HN-EM

A test for a significant difference will be made for each of the socioeconomic variables listed above and other selected variables such as agricultural income, distance from poblacion, distance from main road, urban-rural, etc. The geographic location variables could also be used as control variables in cross-tabulations and not directly involved in tests of significance.

Comparison of the Beneficiaries Over Time

Using the part of the sample that contains the households which were previously in the sample (U₁ and U₂ and U₄), a comparison of the socioeconomic status of these households with their status in January 1977 will include:

- Cooperative electrified households in 1977 with the same class of households in 1980
- Cooperative, nonelectrified households in 1977 with the same class of households in 1980
- Total cooperative households in 1977 and same class of households in 1980
- The above three items for households from municipalities served by privately franchised electric utilities.
- Total households from electrified municipalities in 1977 with households in 1980
- Tests for significant difference will be made as before for all socioeconomic variables and control with geographic location.

Maturation Effect of Electrification

Utilizing the entire sample for electrified areas, the relationship between duration of service and socioeconomic status will be determined by cross-tabulating key socioeconomic variables against duration of electrical service, and controlling as before with geographic variables (1980 data). Evaluation of the impact of electrification on employment of household members will be cross-tabulated with duration of electrical service, also, while controlling for other development projects in the area such as rural roads. A factored variable that represents all socioeconomic variables will be attempted and cross-tabulated with the duration of electrical service.

Other Analytical Considerations for Households

The analysis of the household data will include consideration of

- factors related to energy consumption
- the outreach of rural electrification
- the rural households perception of the quality of management

- the attitude of users toward the cost of electricity

General Analytical Plan for the Business Establishment Survey

The analytical plan for the business establishment survey paralleled the plan used for the household survey.

Summary

It is anticipated by the authors that the analysis described in this paper will produce an understanding of the impact of rural electrification on the rural poor, on employment and on business. It should not only provide us with an understanding of the impact of rural electrification with respect to the project goals but with respect to social and economic changes. This evaluation of the impact of rural electrification was made possible by the institutional capabilities for evaluation developed within the NEA with support from USAID in Manila and the U.S. Bureau of the Census.

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Diagram A Comparisons of Change from 1977 to 1980

1980

		Coop area (Town or Hhs)	Private Utility Area (Town or Hhs)	
<u>1977</u>	Coop area (Town or Hhs)	a ₁	a ₂	A ₃
	Private Utility Area (Town or Hhs)	a ₃	a ₄	A ₄
		A ₁	A ₂	

Diagram B Analytical comparisons of interest for 1980 Hh Survey

		<u>Electrified</u>		
		Coop Area (Town or Hhs)	Private Utility Area (Town or Hhs)	
<u>Non electrified</u>	Coop Area (Town or Hhs)	b ₁	b ₂	b ₃
	Private Utility Area (Town or Hhs)	b ₃	b ₄	b ₄
	Unorganized Area (Town or Hhs)	b ₅	b ₆	b ₅
		B ₁	B ₂	