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Reports on a project funded by A... ... to improve methods for assessing the costs, cost/effectiveness, and cost/benefits of nonformal education and to indicate what is known and not known in the field. With nonformal educational programs gaining prominence in national and regional education schemes, governing bodies, planners, and administrators need to know more about the costs and results of such programs. This paper discusses major documents concerning the costs of nonformal education, including issues of estimating costs and issues of cost-effectiveness and cost-benefit analysis. Several types of costs need to be considered, including hidden, joint, capital, operating, fixed, and variable costs. Cost-effectiveness and cost-benefit analyses rely upon relating these costs to certain outputs. Cost-effectiveness analyses relate costs to quantifiable but non-monetary outcomes, while cost-benefit analyses relate costs to monetary outcomes. While it is conceptually evident how these linkages are made, it is not operationally difficult to make them. Economists have relied heavily upon linear estimation models to make these linkages explicit. Thus, while the elasticities of nonformal education can be estimated, the techniques necessary for such estimations are not readily available to the program director in the field, and the purpose of further work in this project will be to overcome these difficulties by simplifying the techniques for practical application.

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STATE-OF-THE-ARTS PAPER:
COST ANALYSIS IN NONFORMAL EDUCATION*

by

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Educational Testing Service
Princeton, New Jersey
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A STUDY OF THE COST EFFECTIVENESS/BENEFITS IN RELATION TO PROPOSED NON-FORMAL EDUCATION PROJECTS IN LESSER DEVELOPED COUNTRIES

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STATE-OF-THE-ARTS PAPER: COST ANALYSIS IN NONFORMAL EDUCATION

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COST ANALYSIS IN NONFORMAL EDUCATION

1. INTRODUCTION

A. This Project

In July, 1976, the Educational Testing Service began work with the Agency for International Development to improve the analysis of nonformal education with respect to costs, cost effectiveness, and cost benefits.

AID has given greatly increased support to nonformal education in developing countries in recent years, reaching a level in FY 1977 of approximately $47 million; the bulk of this support has been allocated to various rural projects. This expresses the commitment of the United States Government to programs that expressly benefit the rural poor; it also indicates an increased willingness in less developed countries to try more practical and flexible approaches to mass education.

Programs of nonformal education can be found in virtually every country in nearly every functional sector (e.g., agriculture, public health, and family planning), and for audiences of all ages (AID, 1975). With nonformal programs gaining prominence in national and regional educational schemes, it is understandable that governing bodies, planners, and administrators increasingly want to know about costs and results. Recognizing the importance and difficulty of these questions, The Bureau for Technical Assistance, AID, funded a project to improve methods for assessing the costs, cost/effectiveness and cost/benefits of nonformal education.

A first step in the project is this "State-of-the-Arts Paper", which gives an indication of what is known, and not known, in the field. The purpose of the paper is to "get a handle on the problems" by reviewing relevant work to date.

Although no attempt will be made to provide a succinct definition of nonformal education, it is nevertheless useful to point out the kinds of activities that are of central interest in this paper. Wilder, a student of nonformal education, has observed that umbrella terms such as "nonformal education", "out-of-school education", and "lifelong education", are too broad to be useful in research. He suggests that the categorization of these educational programs is useful only when "basic descriptors or parameters of learning" are invoked--e.g., what is the client or learner group? the content? the location of the learning activity? the time frame? the sponsor? (Wilder, 1976)

A huge variety of nonformal programs can be characterized by such descriptors. There are, for example, agricultural demonstrations for farmers. family planning discussions for women's clubs, vocational training for bronze casters, nutritional information for new mothers, orientation sessions for credit union officials, and on, and on. Excluded, of course, is the traditional education provided in every country in the primary schools, secondary schools, and universities.

Concepts and definitions in nonformal education are discussed in a number of books and articles, including Ahmed, 1972; Ahmed, 1975; AID, 1975; Brembeck, et al, 1973; Coombs, 1968; Grandstaff and Hunter and others, Michigan State University (undated); Kleis, et al, 1973.

B. The Literature

It is difficult to find out exactly what has been accomplished in cost analysis of nonformal education. The volume and variety of projects and reports makes an exhaustive search a formidable task. Even with the best intentions, such a search is likely to overlook some useful results, because much of the nonformal education is not labeled as such; rather, it is considered part of the training or extension services associated with agriculture, public health, public

administration, business, or other fields. Further bibliographic annotations do not consisitently indicate whether cost analyses and data are included in reports.

There are a number of helpful bibliographies. The AID bibliography series has a publication on Nonformal Education with 195 references under the headings: I. Definition and Scope, II. Function, III. Delivery Systems, IV. Target Areas, V. Bibliographies (AID, 1975). There is also Paulston's Nonformal Education - An Annotated International Bibliography with 862 references (1972), and a Selected Bibliography on Nonformal Education with 57 unannotated references, published by UNESCO (1971).

At Michigan State University, the Institute for International Studies in Education has contributed significantly to the understanding of nonformal education. The Institute has published several important documents. Among these are Mannan's The Economic Aspects of Nonformal Education: A Selected Annotated Bibliography (1974); the Institute's Topical Acquisition List, No. 1: The Economics of Nonformal Education (undated); and their Topical Acquisition List No. 2: Bibliographies on Nonformal Education (1975). This information is made available by Michigan State through the Information Center on Nonformal Education, which periodically publishes The NFE Exchange.

The International Council for Educational Development (ICED) has also been active in research on nonformal education, including economic aspects. Philip Coombs and Manzoor Ahmed are the principal authors of books, reports, and case studies published in 1973, 1974, 1975. Of particular importance is the volume, Education for Rural Development: Case Studies for Planners. These case studies are recent analyses of nonformal education; taken together they represent the current state-of-the-art in cost-benefit analysis of nonformal education.

Other survey documents of value are Educational Outcome Measurements in Developing Countries: An Annotated Bibliography, (Public Services Laboratory of Georgetown University, 1974) and a bibliography on Cost-Benefit Analysis:

Theory and Application to Manpower Training Programs (United States Department of Labor, 1971). The former includes a section on nonformal vocational and adult education.

In connection with the current project, ETS conducted an ERIC literature search on nonformal education. The result was a valuable annotated bibliography of 547 references (ETS, 1976).

There are at least two other literature sources for the researcher interested in costs and outcomes in nonformal education. The first is organized geographically. There is, for example, the comprehensive study of Nonformal Education in African Development, (Sheffield and Diejomaoh, 1972); and the bibliography of Nonformal Education Programs in Different Geographical Areas of the World, (Colletta, 1971).

Second, there is the "technical" literature, the literature on costing and cost-benefit analysis as applied to nonformal education. An overview is provided by Ahmed in Economics of Nonformal Education (1975). There is also the volume by Philip Coombs and J. Hallak, Managing Educational Costs (1972).

From our perspective, the most significant discussion of educational cost analysis is the report entitled, Cost Analysis for Educational Planning and Evaluation: Methodology and Application to Instructional Technology by Jamison, Klees, and Wells (1976). This work, based on collaborative thought and experience, brings into focus the processes and the problems involved in the determination of educational costs for those who must make decisions about inaugurating or continuing educational programs. In addition, Jamison and his colleagues have sifted some 120 references and have indicated which of these contain important information about the costs of education (cf. Chapter I, Cost Analysis: Methodology). References which might have been added to Jamison's full list are the Review and Synthesis of Cost-Effectiveness Studies of Vocational and Technical Education, (Stromsdorfer, 1973); and the text, Financing and Efficiency in Education, (Zymelman, 1973.)

C. Unfinished Business

As Jamison and his colleagues remarked, "There is by now a reasonably extensive literature concerning educational costs ...." (1976). However, our review of the literature on costs and the literature on nonformal education indicates that seldom do the 'twain meet. Attention to costs and measured outcomes is the exception, not the rule, among hundreds of descriptive reports on nonformal education.

A similar observation was made at the recent conference on nonformal education held at Michigan State University (September 1976). Eleven projects in developing countries were described for conference participants, but built-in procedures to monitor educational costs and results were reported only for the Basic Village Education Project in Guatemala (Academy for Educational Development 1974, 1976). One project director did indicate that a cost-benefit study had been conducted in India and another referred to the costs of extension work per farmer in Mexico. But most speakers were silent about the economic dimensions of their work in nonformal education.

The reasons for the absence of cost analysis in nonformal education must be lack of concern, or lack of data, or some combination of the two. Our own experience in developing countries, suggests that sound cost data are hard to come by even with the best intentions. Moreover, the analytic procedures to be applied to the data are not fully agreed upon by economists--let alone educational planners and administrators.

Errors in determining the costs of nonformal education have been discussed in detail by Ahmed (1976) and Jamison, Klees, and Wells (1976). The latter underline Levin's observation that projects seldom have built-in procedures to collect cost information for evaluation purposes (Levin, 1974). Thus, in most cases, informaion about costs must be gleened from other sources, such as project

budgets set up for accounting and financial control. These sources may or may not reveal significant other costs--e.g., capital costs, administrative and advisory costs borne by sponsors, and the like.

Jamison, et al, also discuss errors in cost estimating due to changes over time, especially inflation. Large errors can occur when historical cost data are projected into the future. They conclude that, "in many respects cost analysis is more an art than a science and needs to be undertaken in this light."

Perhaps what is needed most at this time is to apply in practice, the procedures recommended by Jamison and others in order to test, refine, and simplify them, using data generated by on-going projects in nonformal education. A highly practical approach is particularly important in the ETS project because the end-product is to be a set of procedures that people in the field can use to plan and evaluate projects. The current research is to be the basis for manuals and training sessions for planners and administrators who must estimate realistic project costs and outcomes. Consequently, we must find out by field trial whether procedures laid out by economists can be stripped of verbiage, cleansed of unnecessary formulae, and applied to provide useful information for administrators and educators who are not formally trained in economics. Any simplified procedures must, of course, maintain the integrity of the procedures according to sound economic principles. We do not underestimate the challenge.

2. ECONOMICS OF NONFORMAL EDUCATION

A. Background

In recent years, since the publication of The Economic Value of Education by T.W. Schultz (1963) and Human Capital by G. Becker (1964), economics of education has received considerable attention from many prominent economists. The interests have centered around either macro analysis of the contribution of

education to economic growth, or micro study of the effect of schooling on individual earnings. The first line of research was pioneered by E. Dennis (1962) and Z. Griliches and D. Jorgenson (1966), who came to widely different conclusions. The second line of research has been known as the human capital approach, which was originated from early works of Schultz, Becker, and J. Mincer (1958). The literature on investment in human capital is extensive, as can be seen from a review by Mincer (1970) and a more recent review by Mark Blaug (1976). Neither of these approaches, however, has emphasized nonformal education, though on-the-job training has received some attention, especially by Mincer (1962). Thus, while there is an extensive literature on economics of education, the focus has almost exclusively been on formal education (years of schooling) rather than nonformal education. Furthermore, a considerable portion of this literature is devoted to studying the education in developed countries rather than less developed countries. In fact, it appears that the analysis of nonformal education in less developed countries has not received any attention from economists until F. H. Harbison published A Human Resource Approach to the Development of African Nations (1971) and "Human Resources and Non-Formal Education" in New Strategies for Educational Development, edited by C.S. Brembeck and T. Thompson.

The lack of interest in cost-benefit analysis of non-formal education does not necessarily mean that the framework for project evaluation in general is not available from the literature. On the contrary, there are many relevant publications, though they usually ignore specific problems related to education in general and nonformal education in particular. For example, a useful introduction to cost-benefit analysis can be found in Economic Analysis for Projects by L. Squire and Herman Van Der Tak (1975), as well as in The Appraisal of Development Projects by M. Roemer and J.J. Stern (1975). It remains true, however, that

applications of cost-benefit analysis to education are somewhat limited, and they usually examine only some specific programs for formal education, such as "compensatory education" or "year round schools." Some examples of this literature include An Evaluation of the Cost Effectiveness of Alternative Compensatory Reading Programs (Vol. 1: Cost Analysis) by Dienemann, et al (1974), and The Effects of Year-Round Education on Cost and Public Supports by R.J. Staaf (1973). A more general discussion is found in Program Cost Analysis in Educational Planning by S.A. Haggart (1971). These studies generally deal with cost analysis of alternative educational programs proposed for formal educational systems of the United States.

Thus, despite the existence of extensive theoretical literature on economics of education and some practical applications of cost-benefit analysis to education, the state-of-the-art of economics or cost-benefit analysis of nonformal education can be said to be extremely limited. Ahmed (1975) came to the same conclusion and stated, "since the materials covered, problems treated, and the specific techniques used have been all in respect to formal education, the special features of nonformal education and the special problems of techniques and methods posed by non-formal education have not been taken into account in the intellectual efforts devoted so far to the subject."

B. Some Major Methodological Problems

There are several major methodological problems that are frequently encountered in evaluation of nonformal education. While these problems are not necessarily unique to nonformal education, their treatments have apparently caused some difficulties. The major methodological problems usually encountered are as follows:

1. "Hidden Costs." The problem of hidden costs is related to a general issue--the question of "cost to whom?" It is also related to the distinction that must be made between "economic cost" and "accounting cost." In many

evaluation studies, capital costs are ignored simply because they are donated by an outside agency. Furthermore, excessive reliance seems to have placed on budgets expressed simply in terms of dollar figures without adequately separating quantities of inputs from their prices. Errors in analysis can arise, for example, in dealing with such resource inputs as volunteers, "free" radio time, borrowed facilities, and "opportunity cost" for trainees.

In principle, this problem can be resolved by first identifying all inputs required in terms of physical units. the second step in assessing costs requires an answer to the question, "cost to whom?" In doing this, a differentiation may be made between "private cost" and "public cost."

Thus, a critical step in cost-benefit analysis, or the more limited scope of cost analysis, is to enumerate all input requirements. The determination of appropriate price levels can be treated somewhat separately, which may involve intertemporal adjustments, cross-country comparison, sensitivity studies to determine effects of price changes, or perhaps a more complex issue of equilibrium between supply and demand as well as so-called "shadow price." In practical terms, applications of some conventional methods for dealing with the problems associated with inflation, foreign exchange, etc. will be sufficient.

2. Joint Costs in Joint Production. The joint cost problem is important not only because many nonformal education projects are designed as a complement to formal education and share its facilities and staff, but also because most nonformal education projects are developed to fulfill several distinct tasks. In fact, one of the main reasons why nonformal education appears to have relatively low cost, compared with formal education, is because many of its inputs are priced on the basis of marginal costs; most of the capital expenses and part of the operating expenses may be borne by formal education or other activities. Such an approach can be justifiable so long as the operation of nonformal education remains marginal. Conventional cost accounting, on the

other hand, normally allocates costs on the basis of average costs, although for purposes of economic analysis this may lead to erroneous results.

One of the most prevalent and natural cases of joint costs is the allocation of capital expenses over different time periods. One frequently used approach is to determine depreciation cost per period by dividing capital costs by the asset's expected lifetime. Some analysts add a capital charge equal to the rate of discount times the original value of the capital; this was done, for example, by Schram, et al in the IIEP (1967) case studies reported in New Educational Media in Action. As pointed out by Jamison, et al, (1967), this procedure is not strictly appropriate, since it fails to take into account the changing value of the capital over the project life. A more appropriate procedure is to determine annualized cost by using an "annualization factor," as discussed, for example, in Kemeny, et al (1962, Chapter VI). The annualized cost is computed simply by multiplying the original capital value by an appropriate annualization factor that is determined by the lifetime of capital and the discount rate chosen. The procedure implicitly assumes that the utilization of capital is evenly spread over its lifetime. In reality this is not likely to be the case, and therefore, some further refinement may be required. An attempt at such refinement that takes into account student utilization patterns over time has been proposed by Jamison, et al. Other refinements are possible and should be explored. Ideally a cost-benefit analysis should be conducted for the entire project lifetime, with all costs (including start-up costs) discounted to a common point in time.

3. Difficulty in Isolating the Impact of Nonformal Education. The problem mentioned above arises mainly because of the multiplicity of outputs. An analogous problem may arise also because of multiplicity in inputs of which nonformal education is merely one of the many factors that influence the level of skill,

employment, and/or earnings. Thus, the impact of nonformal education on economic development in a rural society cannot be easily isolated from the influence of other factors. Any statistical attempt to evaluate the effects of several factors that might have contributed to an increase in some measure of output or earnings must inevitably rely on vastly over-simplified analytical models. For example, yields per acre of individual farms in the communities with and without the benefit of some specific agricultural service or agricultural training program may be significantly different. But it is difficult to determine how much should be attributed to any specific service or program, not only because available empirical data are limited, but also because plausible theoretical models are difficult to formulate. Anyone who has experience with the technique of regression analysis must be aware of the fact that the conclusions are sometimes drastically affected by the choice of functional forms or theoretical models. To make the matter even worse, such analyses are invariably plagued by the problem of severe multicollinearity. which greatly reduces the confidence that one can place in the assessment of relative effects of different determining factors. Complexity is considerably increased if the analyst attempts to take into account the issues related to externalities or economies of scale. The problem of externalities is difficult to handle mainly because of unclear causal relationships; and the information on economies of scale is difficult to obtain largely because of the unique nature of many projects.

C. Cost Analysis

Earlier we pointed out the importance of identifying the physical quantities of required inputs as a first step in any cost analysis. In principle, this should be done for each year during the expected lifetime of the project. As a second step, the actual (or expected) prices for all inputs over the

corresponding time period should be collected. To reduce this quantity and price information into a total cost figure it is necessary to express the prices in the same currency at a constant dollar basis (say, 1977 U.S. dollars). By appropriately discounting the future annual costs, including both capital and operating expenses, a total cost for the entire project may be computed. When desirable one may compute a measure of "unit cost," such as average annual cost or average cost per student.

Alternatively, annual costs may be estimated by adding annualized costs for all capital items to the sum of all operating costs. Again, various measures of "unit costs' may be computed based on annual costs so derived. In general, the cost items incurred for uses beyond the current time period (usually one year) may be regarded as capital costs while all other items are considered operating costs.

While the distinction between capital and operating costs is important for calculating annual costs using an annualization procedure, other classifications of cost items are useful for some purposes. For example, to understand the relationship between total cost and the level of output it is important to know the nature of the cost function. Each cost component can be categorized as fixed or variable, depending on whether or not the particular cost item is independent of the level of output. Thus, staying within a static analytical framework, total cost (C) can be separated into fixed cost (F) and variable cost (V). In symbols, we have

$$C(Q) = F + V(Q)$$

where C(Q) and V(Q) indicate that total cost and variable cost are dependent on the level of output (Q). In addition to total cost, average cost (A) and marginal cost (M) can be computed as

$$A(Q) = C(Q)/Q$$

and

$$M(Q) = dC/dQ = dV/dQ$$

respectively. In general, both A(Q) and M(Q) vary with the level of output. Furthermore, A(Q) and M(Q) are expected to be different, except when F=0 and V(Q)=kQ, implying A(Q) = M(Q) = k. Most cost analyses of nonformal education projects provide only a crude estimate of $C(Q_o)$ and $A(Q_o)$, where Q_o is a given level of output. Because the nature of the cost function is not known, and the separation of fixed cost from variable is not made, little information is available for predicting total cost, average cost, or marginal cost at some other level of output or operation.

D. Cost-Effectiveness and Cost-Benefit Analyses

Cost-effectiveness and cost-benefit analyses address the question of relating the cost of resource inputs to given outputs. While both forms of analysis are concerned with the ratio of inputs to outputs, the units of measure differ. A cost-effectiveness analysis is used in cases in which the outputs cannot be expressed in monetary terms because of the absence of suitable market prices. Most studies of the economics of education focus on effectiveness, rather than benefit, as the output is typically some measure of cognitive learning, i.e., test scores.

Only when monetary prices exist for an output quantity can cost-benefit analyses be performed. In this case, the monetary returns for an activity can be compared with its monetary costs. The fact that inputs and outputs are expressed in a single common monetary unit permits one to calculate the rate of return, for example, on the expenditures for the activity.

Both cost-effectiveness and cost-benefit analyses presuppose that there is an "output" which can be produced by a given "firm" through the combination of various inputs. Education is an input which is associated with a firm's worker or manager. Welch (1970) has identified two areas in which education can be expected to have an economic effect on the firm's output: worker effect

and allocative effect. The worker effect comes from the enhancement of a worker's ability to increase output without a corresponding increase in resource inputs--that is, the "production possibility" curve is shifted upward by virtue of the worker's greater knowledge; this effect is also referred to as increasing the "technical efficiency" of the firm. The allocative effect comes from the ability of an educated worker (or manager) to choose a combination of resource inputs that increases the economic value of outputs, given a constant state of production technology.

In addition to those two forms of educational effects, Jamison (1976) has identified a "Pareto" effect, by which a worker who is not working at the "frontier" of his production possibilities curve may become more efficient by choosing an "activity vector with more of a valuable output or less of a costly input, everything else being the same." A fourth type of effect, the market effect, would imply that the educated worker would have greater information about relative prices for goods or services and would thus be better able to obtain such prices for whatever output he or she produces.

From a methodological standpoint, these various effects are not entirely distinguishable (Jamison, 1976). For example, in practice it is difficult to differentiate between an upward shift in the production possibility curve and a movement toward the production possibility curve (i.e., becoming more efficient in exploiting existing technology).

It is however, possible, to differentiate between technical, allocative, and market efficiency, as these three forms of efficiency may be estimated using various forms of regression techniques. Using regression methodology, it is possible to determine whether the "educated firm" produces more of a given commodity, chooses to produce a combination of outputs which gives the total firm more profit, and manages to obtain higher prices for a given level of output than the less educated firm. In making the estimates of the effect of education on production, earnings and prices, three forms of functions are analyzed:

1) Production functions, which typically use a gross quantity of output with no price attached to the unit of output, 2) earnings functions, which typically use an aggregate of output, with prices attached to each element of the aggregate, and 3) price functions, which explore the types of prices obtained for a given type of output. The dependent variable of a production function roughly corresponds to what is called the "effectiveness", and the dependent variable of an earnings function roughly corresponds to what is called the "benefit". In both cases, the function to be estimated can be of the form:

$$Y = b_o + \sum_{i=1}^{n} b_i \cdot x_i$$

In production functions, Y is expressed in terms of quantity of output; in earnings functions, Y is expressed in monetary terms. Education is one of the X_i production input terms, usually expressed as the level of education attained, whether or not literate, or whether or not exposed to some nonformal training.

To conduct a cost-effectiveness study or a cost-benefit study, therefore, it is necessary to know not only the cost of the level of educational input, but also to know how this level of educational input affects either production or earnings. We will not, at this point, consider further issues regarding either the "Pareto" effect or the market effect, as the literature contains little empirical work in this area.

3. EDUCATION AND AGRICULTURAL PRODUCTIVITY

While the effects of education on health, literacy, or political efficacy may be substantial, these products are often difficult to associate with a price. Agricultural output, however, is more amenable to such analysis, since there is both a product (the "produce," as it were) and a price. In the remainder of this discussion, therefore, we will review the state-of-the art of the effects

of education (both formal and nonformal) on agricultural productivity and earnings. This review will focus on micro-economic analyses, with the educational level of the farmer as the source of education effects; at more aggregated levels, there is a large literature (Foster and Sheffield, 1974).

Production (Effectiveness). There are consistent findings that indicate that exposure to agricultural extension--one form of nonformal education--is related to increases in crop production. In a study of 321 farms in Kenya, Hopcraft (1974) found that exposure to extension and/or demonstrations was significantly related to maize production. In the same country, Moock (1973) found that extension contact was related to maize crop yield for 152 farms; in this study, however, no evidence was found that exposure to demonstration was related to crop yield. A study of 895 farm households in Korea (Hong, 1975) found that exposure to extension was related to overall crop yield and to rice production specifically. In addition, a study of 274 farm households in the Philippines (Halim, 1976) found that total extension contact was related to rice production. Finally, in a study of 440 farm households in Thailand (Jamison, Lau & Lockheed, in process) it was found that extension contact was related to rice production.

Similar evidence exists to relate the farmer's level of formal education to the quantity of farm output; in most studies of the effects of formal education, however, some form of aggregate farm output is more frequently considered as the output variable. There are, however, findings from Kenya, Korea, Nepal, Philippines and Thailand that relate formal education to farm output. For example, Moock (1973) found that schooling was related to maize crop yield. In addition, Hong (1975) found that both the farm operator's education and the average education of the farm family members were related to the crop yield and to rice production. In a study of 138 farms in Nepal, Sharma (1974) found that

the literacy of the farm operator was related to the gross quantity of paddy or wheat produced. Halim (1976) found that in the Philippines, the average schooling of the adults and children was related to annual rice production. Similarly, Jamison et. al. found that the schooling of the head of the farm household was related to rice output.

There are a few studies which contradict these findings. For example, Hopcraft (1974) found that schooling was not related to aggregated farm output, and was negatively related to maize production. Similarly, in a study of 310 farms in Taiwan (anonymous, 1976), it was found that the amount of schooling of the farm operator was not related to crop output.

Earnings (Benefit). There are very few studies which actually relate non-formal education to increases in farm earnings. However, in each of the studies reported, the relationship between exposure to some form of agricultural extension was positively related to farm earnings. In a study of 971 farmers in Japan, Harker (1973) found that the use of agricultural magazines. of extension agents and of agricultural broadcasts on the radio was related to gross sales of farm products. Hopcraft found that exposure to extension and/or demonstrations was significantly related to aggregated farm output in Kenya. And in Korea, Hong found that exposure to extension was related to family income and to agricultural income.

The evidence supportive of the assertion that formal education increases earnings is quite substantial, although it is subject to the criticism that social class differences may increase both the likelihood of school attendance and of high earnings. Nevertheless, studies in Greece, India, Israel, Japan, Kenya, Korea, Nepal, the Philippines, Taiwan and Thailand all show evidence that formal education and farm earnings are related. In a study of 430 farm households in Greece, Yotopoulos (1967) found that the average total years of schooling of adult household members was related to the value of the agricultural produce. In a study of 1038 farms in India, Chadhri (1974) found that both

the average schooling of all workers in the household and the education of the head of the household was related to the gross value of the agricultural produce. In the same country Sidhu (1974) found for three separate samples (of 236, 369, and 132 farms, respectively) that the average schooling of the adult household members was related to the gross sales of multicommodity farms and to the aggregate farm output. In Israel, Sadan, Nachmias, and Bar-Lev (1976) found that in a study of 1841 dairy farms, the schooling of the farm operator's wife was related to the gross value-added of the farm produce. In a study of 971 farmers in Japan, Harker (1973) found that, while education was not directly correlated with farmer's gross sales, the farmer's years of schooling completed was related to obtaining farming information, which in turn was related to mechanized farming, and in turn related to the total farm sales. In Korea, Hong (1975) found that both farm operator's education and the average education of the farm family members were related to the total income of the family. Similarly, in a study of 102 farms in Nepal, Pudasaini (1976) found that the number of years of formal schooling of the farm operator was related to the gross farm revenue. In a study of 649 farms in Taiwain, Wu(1972) found that the years of schooling completed by the farm operator was related to the gross farm income. Finally, in Thailand, Jamison et al.(in process) found that the schooling of the head of the household was related to both profits and better factor input prices. In only one study (Halim, 1976) did we fail to find evidence that schooling was unrelated to earnings. For more detail on these studies, the reader is referred to the extensive documentation in Table I of the Appendix.

What is apparent in examining these studies, however, is that size of the estimated effects and benefits of education largely depend upon the other variables considered in the production function. Thus, the effect of extension is less when considered simultaneously with formal education, and the interaction of these terms is usually significant, implying that schooled farmers benefit

more from nonformal training than do unschooled farmers.

The measurement of the effects of either formal or nonformal education in terms of agricultural output (gross product, or aggregate value) depends upon the accurate measurement of other factors that are likely to determine output, such as land size, fertilizer use, irrigation, quality of seed, and the availability of credit. To the extent that these may be determined by agricultural education, formal or nonformal, it is important that these interrelations be considered. For example, while exposure to nonformal education in Japan was unrelated to the gross sales of farm produce, exposure to nonformal education was related to mechanized farming, which was in turn related to total farm sales (Harker, 1973). Since to a large extent farm output is determined by the obvious non-educational factors mentioned above (and these factors account for upwards of 85% of the variance in farm produce), it is methodologically very difficult to determine either the effectiveness or the benefits of educational efforts in this area. In the Appendix referred to above, we have indicated the effects of both nonformal and of formal education with regard to farm outputs. The reader will observe the extreme variability of the results (without having the opportunity to explore the complicated mathematics by which these estimates were computed.) The effect of school is measured by the relation of an educational input to an output. For example, in Moock's study the percent increase in maize production from a given amount of contact with an extension agent was 8%; similarly, Halim estimates an overall rate of return to extension at 8.12 for each 5.69 invested.

In conducting an adequate cost-effectiveness or cost-benefit analysis, it is necessary to perform this estimation of the effect of nonformal education; most such attempts specify the Cobb-Douglas production function, and apply a standard least-squares regression technique in which both the independent and dependent variables are expressed in logarithmic form. Since there are very few studies of nonformal education which both estimate the cost of

the unit of education and the effect of the educational input, it is very likely that persons in the field will find it difficult to do the analysis on an ad hoc basis.

4. Other Selected NFE Case Studies and Issues

As we have seen, there exists considerable interest in nonformal education as an alternative to formal education for disseminating agricultural and health information and for developing various craftman skills. Perhaps the most important case studies dealing with nonformal education are those prepared through ICED for the World Bank and UNICEF. Most of the nonformal education projects evaluated in these studies are described in Ahmed (1975), Coombs, et. al. (1973, 1974, and 1975), as mentioned previously. A collection of seventeen case studies that resulted from the ICED work is contained in Education for Rural Development: Case Studies for Planners, edited by Ahmed and Coombs (1975). In addition, Sheffield and Diejamaoh (1972) also provide four major case studies and numerous brief studies of nonformal education projects in Africa.

In most of these studies quantitative information on cost and effectiveness or benefit is very limited, especially regarding quantitative measures of effectiveness or benefit. When cost data are available, apparently only simple calculations of "unit cost" are feasible, perhaps mainly because most projects are unique and have relatively short histories. How the total cost (or average cost) of a nonformal education project may be expected to vary as the scale of operation is changed has apparently never been explicitly considered.

In a recent cost analysis of instructional TV and radio projects, Jamison et. al. (1976), attempted to estimate cost functions of several TV and radio projects in El Salvador, Korea, Mexico, Nicaragua, and the United States. They show how the costs of instructional TV and radio projects may be expected to vary according to the number of students and program hours, using the concept of a cost function. Most of their case studies are associated with formal rather

than nonformal education; nevertheless, what has been accomplished in this study seems to indicate that cost analysis of nonformal education, especially if it is applied to a relatively large-scale and long-term project, can be further improved along the same line.

Notice that the "cost function" as used in Jamison, et. al., which expresses the total cost of a given project as a function of the number of students and hours of instruction, is not exactly the same as the traditional cost function, which shows the relationship between total cost and a single measure of output. Whether the number of students and hours of instruction are regarded as inputs or outputs, it is sometimes desirable to obtain a single measure of effectiveness or benefits--e.g., the level of learning achieved by students or the opportunity of applying newly acquired skill.

This brings us to the issue of cost-effectiveness and cost-benefit considerations. As difficult as this issue is, we are convinced that it must be given adequate attention. Cost analysis alone loses much of its usefulness because a given project must ultimately be judged not only on the basis of its cost but also on its accomplishments--i.e., effectiveness and/or benefits.

The state-of-the-art of cost analysis of nonformal education projects is best illustrated in a table by Ahmed (1975, Table 4, p. 52), which compares cost determinants of six important training programs covered by recent ICED studies. As shown, "cost per trainee per course" (which ranges from one to two weeks to ten months) for the SENA/PPP-R mobile training program in Colombia and IRRI/RPT rice production training program is $20 and $3,249, respectively. Other quantitative data provided in the table include the number of staff per center (from 1 to 10), the duration of the course, and the number of trainees per staff member (from 5 to 25).

The scope of cost-effectiveness analysis of nonformal education is even more limited. Among the six training programs that were given quantitative

estimates of "cost per trainee per course," Ahmed (1975) included three in his discussion of cost-effectiveness. The information that was provided in each case was limited to one to two paragraphs of qualitative evaluation, apparently due to the lack of quantitative data. For example, commenting on the Mobile Trade Training School (MTTS) in Thailand, he suggested that "the cost-effectiveness of the program can be improved by designing the training content on the basis of prior exploration of the kinds of training that are most needed...." However, evidence is lacking on how the introduction of new training content may effect cost and/or effectiveness.

In commenting on the Farmer Training Centers (FTC) in Kenya, Ahmed noted that "During recent years, however, a number of problems have become evident: serious underutilization of capacity has developed; the attendance rate of farmers and their wives dropped ...." This raises the question as to whether adequate cost-effectiveness analysis can be made without considering the potential utilization rates over a reasonable planning horizon. In particular, an accelerated depreciation may be required if the capital involved is expected to be used less extensively in later years.

Reports on the individual ICED case studies (which form the basis of Ahmed's book, 1975) provide more detailed information on each project. Many of the seventeen case studies included in the book cover several nonformal education projects, so the number of nonformal education projects actually evaluated is considerably larger. The volume is organized in two parts: I. "Programs for basic general education," serving mainly rural children and youths; II. various "programs for employment related education," oriented mainly toward adult education.

In general, quantitative data available for cost analysis or cost/benefit analysis are extremely limited, especially for the programs designed to provide basic general education. In fact, among the nine case studies reported in Part I, only the study of Colombia's ACPO program presents anticipated operating expenses

in several components, as follows:

Anticipated Operating Expenses of ACPO, 1972

Category	Anticipated Expenses (million pesos)	% Devoted to Nonformal and Informal Education
1. Radio system program production and creative staff	12	60
2. Cultural Division teaching and textbook departments	14	100
3. Operation of publishing houses, books, etc.	20	40
4. Newspaper	7	100
5. Regional activities including regional stations and staff	15	30
6. Administration	18	61
TOTAL	86 (approximately $4.3 millions)	391

Because of a wide range of activities carried out by the ACPO project, it is clearly very difficult to compute some meaningful "unit cost", although the impacts of the program can be measured in several dimensions.

In Part II of Education for Rural Development, which includes programs for employment-related education, considerably more quantitative information is provided in some of the case studies, especially the mobile skill training program for rural area (PPP-R) in Colombia, the farmer education programs (ODR) in Korea and the Mobil Trade Training School (MTTS) in Thailand.

For example, in Colombia the available quantitative data were sufficient to calculate various measures of "unit cost", including cost per student hour for the mobile skill training program (PPP-R). In the same study (1970), capital investments in various regional centers ranged from zero to more than 20% of total budget. From the report it is not clear how capital investment is treated

in computing "unit cost." Furthermore, only the sum of recurrent expenditures was reported for each regional center. Therefore, it is impossible to determine how these expenditures were made.

In this respect, the report on the MTTS program in Thailand does present more information. For example, it is stated that an estimate of the average annual cost for an individual school can be broken down as follows:

Estimated Cost of MTTS School

Category	Cost (thousands of $)
Recurrent Costs	
Salaries	$ 10
General expenses	5
Overtime and personnel benefits	5
Supplies and materials	10
Miscellaneous	3
TOTAL	$ 33
Capital costs (one time)	81

One of the major deficiencies of such a cost analysis is the fact that only aggregate costs of various components are reported, not unit prices. Thus, it is impossible to determine how many staff, or how many textbooks, etc. were provided and used.

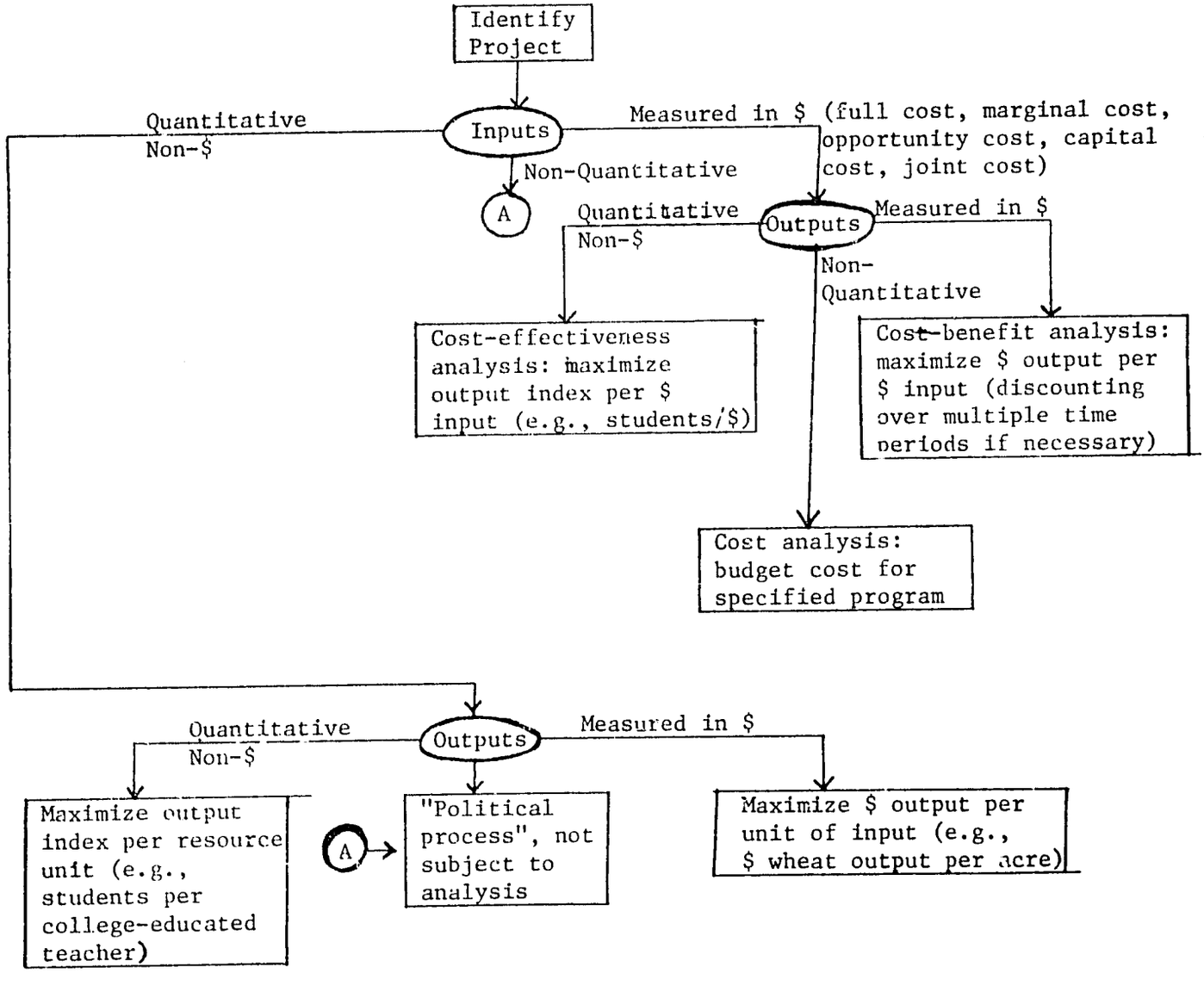
5. SUMMARY

The purpose of this paper has been to review the state-of-the-art of cost analysis in nonformal education. The paper has discussed major documents concerning the costs of nonformal education, including issues of estimating costs and issues of cost-effectiveness and cost-benefit analysis. We have also reviewed

studies of effectiveness and benefit in agriculture and case studies of costs in nonformal education.

We have noted that there are several types of costs to be considered, including hidden costs, joint costs, capital costs, operating costs, fixed costs and variable costs. We have also noted that cost-effectiveness and cost-benefit analyses rely upon relating these costs to certain outputs.

Cost effectiveness analyses relate costs to quantifiable but non-monetary outcomes, while cost-benefit analyses relate costs to monetary outcomes. These relationships may be expressed schematically as follows, focusing on a specific project.



At this point in time, while it is conceptually evident how these linkages are made, it is operationally difficult to make them. Economists have relied heavily upon linear estimation models, using census or survey data, to make these linkages explicit. Thus, while the elasticities of non-formal education can be estimated, the techniques necessary for such estimations are not readily available to the program director in the field. It will be the purpose of this project to overcome these difficulties by simplifying the techniques for practical application.

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Appendix Table I

Micro-production Function Studies of Formal and Non-Formal Education's Contribution to Agricultural Productivity

Country and Author	Sample	Analytic Method	Other than Schooling Factors in Equation	Effects of Schooling	Other than Non-Formal Education Factors in Equation	Effects of Non-Formal Education	General Findings and Comments
Greece (Yotopoulos, 1967)	Random sample of households in 110 villages and 3 cities of Epirus, 1963. Of 650 in sample, responses of 430 farm households were analyzed.	Cobb-Douglas production function	1. Man-days worked (with female and child labor as a percent of male labor) 2. Land under cultivation 3. Estimated value of current services of plant plus operating expenses of plant 4. Estimated value of current services of equipment plus operating expenses for equipment 5. Estimated value of current services of live capital plus operating expenses for live capital	Average number of years of education of farm household members age 15-69 with gross value of agricultural production: β^{*} = .138 ($p < .05$). Marginal product of education was calculated as 606.40 drachmas per one year change in average household education.	None	None	Positive effect of education on agricultural productivity.
India (Chaudhri, 1974)	Population (1038 households) of 21 villages in the wheat belt of Punjab, Haryana and Uttar Pradesh surveyed in 1961-1964	Cobb-Douglas production function	1. Area cultivated 2. Area irrigated 3. Value of seeds 4. Value of chemical fertilizer 5. Nature of farm-yard manure 6. Nature of labor used 7. Number of bullocks	1. Number of years of schooling for all agricultural workers in the family with the gross value of agricultural produce: β = .116 ($p < .01$). Marginal product of education was calculated as 107.04 rupees. 2. Number of years of schooling for head of household with the gross value of agricultural produce: β= .114 ($p < .01$). Marginal product of education was calculated as 153.12 rupees.	None	None	Positive effect of education on agricultural productivity.

*β is the coefficient of the education term in log form. It is interpretable as the percent change in the dependent variable which may be attributed to the independent variable. It is not the standardized correlation coefficient.

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Country and Author	Sample	Analytic Method	Other than Schooling Factors in Equation	Effects of Schooling	Other than Non-Formal Education Factors in Equation	Effects of Non-Formal Education	General Findings and Comments
India (Sidhu, 1974)	1967 - 68: 150 farms in the Ferozepur district of Punjab 1968 - 69: 150 farms in the Ferozepur district of Punjab 1970 - 71: 7 wheat farms in 4 districts in Punjab.	Ordinary least squares regression. Independent variables in log form. Dependent variable is possibly non-log form.	1. Labor - total man hours (female or child labor - 1/2 male labor). 2. Land - acres of wheat grown. 3. Capital services-aggregate of asset specific services plus seed costs. 4. Current value of chemical and farm produced fertilizer. 5. Wheat type: dummy for old (vs. Mexican).	Average years of school of farm household member older than 13 1) with wheat production: β= .038 ($p < .10$) in 1967 - 68 for N=236. 2) with Mexican wheat production: β= .036 ($p < .05$) in 1967 - 68, 68-69, 70-71 for N=369. Marginal product = 66.5 rupees. 3) with gross sales of farm produce: β= .028 ($p < .10$) in 1968 - 69 for N=132. Marginal product = 323.6 rupees. 4) with value added of farm produce: β= .125 ($p < .10$) in 1968 - 69 for N=132. Marginal product = 418.5 rupees.	None	None	Education is related to production efficiency but more strongly to allocative efficiency. The data base of this study is poorly defined.
Israel (Sadan, Nachmias and Bar-Lev, 1976)	Population of 1,841 dairy farms under supervision by Supplement Agency in Israel (1969 - 70).	Multiple regression	1. Herd size 2. Use of irrigation 3. Family size	The schooling of the farm operator's wife with the gross value added of farm production: β= 21.1 ($p < .01$). Marginal value added was $21 U.S. dollars per year of wife's schooling.			

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Micro-production Function studies of Formal and Non-Formal Education's Contribution to Agricultural Productivity

Country and Author	Sample	Analytic Method	Other than Schooling Factors in Equation	Effects of Schooling	Other than Non-Formal Education Factors in Equation	Effects of Non-Formal Education	General Findings and Comments
Japan (Harker, 1973)	Representative sample of 971 middle-aged farmers in Central and Southern Honshu, Shikoku and in the Fukuoku areas of Kyushu, in 1966.	Path analysis	1. Use of agricultural magazines, extension agents, and agricultural broadcasts. 2. Index of ownership of power implements. 3. Controlling for father's education, farm location, farmer's age and farm size.	Years of schooling completed with gross farm sales, β= .02 (ns).	1. Index of ownership of power implements. 2. Years of formal school. 3. Controlling for father's education, farmer's age and farm size.	Use of agricultural magazines, extension agents, and agricultural broadcasts with gross farm sales, β= .14 ($p < .001$).	No marginal value for either formal or non-formal education was estimated.
Kenya (Hopcraft, 1974)	Stratified random sample of small farms in Kenya, (1969 - 70) out of ~ 1700, 674 cases analyzed.	Cobb-Douglas	For maize production: 1. Acres of land in maize. 2. Labor used. 3. Value of purchased inputs used. 4. Extension exposure	Maize production with 2 or 3 yrs. of schooling, β= -.030 (ns); with 4 - 6 yrs. of schooling, β= -.1632 ($p < .05$); with primary completed or more, β= -.1481 (ns).	For Maize Production: 1. Acres of land in maize. 2. Labor used. 3. Value of purchased inputs used. 4. Formal schooling.	Maize production with 1-3 Extension visits, β= .1529 ($p < .05$); with 4-6 visits, β= .2721 ($p < .05$); with more than 7 visits, β= .0349 (ns); with one Farmer Training Center course attendance, β= .1347 ($p < .05$) with 1 or 2 demonstrations, β= .3932 ($p < .05$) with 3 or more demonstrations, β= .1968 ($p < .05$).	"Education services aimed at farmers generally have the effect of increasing the physical output that the farmer receives by increasing his use inputs, and that the net effect of the farmer's profits is negligible" (p. 192)
			For aggregate farm production: 1. Land Acreage 2. Labor 3. Value of tools and equipment 4. Value of buildings 5. Value of livestock 6. Value of purchased inputs 7. FTC, demonstrations, Barazas, extension	Aggregate farm production with formal schooling, β= -.0049 (ns).	For aggregate farm production: 1. Land acreage 2. Labor 3. Value of tools and equipment 4. Value of buildings 5. Value of livestock 6. Value of purchased inputs 7. Schooling	Aggregate farm production with FTC, β= .0281 (ns); with demonstrations β= .0466 ($p < .05$); with extension contact, β= .0394 (ns)- with all 3 variables in equation simultaneously. Marginal value of FTC computed at 37.6 shillings (or 4.7 increase in total value); marginal value of demonstrations computed as 31.08 (or 3.7 increase in earnings).	

Appendix Table I

Micro-production Function Studies of Formal and Non-Formal Educat

Country and Author	Sample	Analytic Method	Other than Schooling Factors in Equation	Effects of Schooling	Non-Formal Education Factors in Equation	Effects of Non-Formal Education	General Findings and Comments
Kenya (Hoperaft, 1974, cont'd)					For value added: 1. Labor 2. Tools and equipment 3. Land, rental value 4. Schooling, sch^2 5. Years experience, years experience^2 6. Age, age^2 7. Settlement dummy	No value added for extension.	
						Value added (profit) with FTC attendance, β= .1099 (ns); with extension agent visits, β= .0203 (ns); with demonstration attendance β= .0054, (ns). Omitting FTC and extension visits from equation, with demonstration attendance β= .0719 (p < .05).	
(Moock, 1973)	72 recipients of maize loans and 88 additional farms in Vihiga (1971).	Cobb-Douglas and linear	1. Interplanted crop 2. Hybrid seed 3. Plant population 4. Insecticide 5. Rate of phosophate 6. Rate of nitrogen 7. Previous season 8. Labor/acre in man hours 9. Damage via hail, etc. 10. Extension 11. Loan 12. Migration/age 13. Female manager	Manager's educational attainment greater than 3 years with bags of maize produced, β=.067 (p < .10). Marginal product of schooling = 1.2 bags per year of school.	1. Interplanted crop 2. Hybrid seed 3. Plant population 4. Insecticide 5. Rate of phosophate 6. Rate of nitrogen 7. Previous season 8. Labor/acre in man hours 9. Damage via hail, etc. 10. Schooling 11. Loan 12. Migration/age 13. Female manager	Extension index with maize production β= .010 (p < .10). Crop demonstration with maize production β= .049 (ns); agent initiated extension contact β= .082 (p < .10).	
Nepal (Pudasaini, 1976)	Random sample of 102 traditional and mechanized farms in Bara District, 1975.	Cobb-Douglas production function	1. Land 2. Labor 3. Cash expenses 4. Value of bullock 5. Value of machine and tools 6. Land fragment 7. Bullock labor 8. Tractor labor 9. Pumpset use 10. Dummy variables relating to tractor and pumpset use	Years of formal schooling of farm operator with gross farm revenue β= .0137 (p < .05), N=102. With gross farm revenue less income from tractor rental, β=.0139 (p < .05), N=102. Marginal value product of education calculated at 503.18 rupees per year.	None	None	Positive effect of school on farm revenue.

Appendix Table I

Micro-production Function Studies of Formal and Non-Formal Education's Contribution to Agricultural Productivity

Country and Author	Sample	Analytic Method	Other than Schooling Factors in Equation	Effects of Schooling	Other than Non-Formal Education Factors in Equation	Effects of Non-Formal Education	General Findings and Comments
(Sharma, 1974)	Subsample of a stratified random sample of households in 15 village panchayztsim Rapandehi, N=138, 1968-69.	Unrestricted Cobb-Douglas	1. Land - acreage planted by crop 2. Labor - family and hired (female = .8 male; child = .5 male) 3. Seed - quantity 4. Organic manure - quantity	Self reported literacy with total wheat production β=.1417 ($p < .10$), for N=87. With paddy production β= .0816 ($p < .10$), for N=138. Estimated output increase for 100% literacy = 15% for wheat and 8.5% for paddy.	None	None	Positive effect of literacy on productivity.
Korea (Hong, 1975)	Random sample of approximately 1200 farm households in 9 providences, with 895 cases analyzed.	Log-linear. Dependent measures in non-log form	1. Capital including farm assets, depreciation charge, interest charges and operating expenses. 2. Labor man hours 3. Acreage per farm 4. Extension investment per farm 5. Age and age² of farmer 6. Interaction terms	Educational attainment of farm operator with total family income: β= .5706 ($p < .01$) for N=895. Average education of family members with total family income: β= .6328 ($p < .05$) N= 895; with agricultural income: β= .3345 ($p < .05$) N= 895. Marginal product of schooling = 73,574 won per educational unit (i.e., from primary to middle school completion). Farm operator's schooling with rice production β= .7123 ($p < .05$). Marginal product estimated at 68,040 won per level.	1. Capital including farm assets, depreciation charge, interest charges and operating expenses. 2. Labor man hours 3. Acreage per farm 4. Education of farm operator 5. Age and age of farmer 6. Interaction terms	Investment in extension with family income: β= .5210 ($p < .05$). Marginal product estimated at 4.028 won per year for each 1 won invested in agriculture extension. Investment in extension with agriculture income: β= .8691 ($p < .01$) N=895. Marginal product estimated at 4.49 won / year for each / won invested in agricultural extension. With rice production β= .8319 ($p < .05$) Marginal product estimated at 4.49 won per 1 won invested.	In the appendix a Cobb-Douglas rice production function is estimated. β (extension) = 3.240 ($p < .01$) and β (education) = .927 (ns). Education x extension interaction β = .605 ($p < .01$). A definite attempt at a cost-benefit micro-analysis of extension. Since extension investments were made at a district rather than at the farm level, the aggregation for this analysis should (possibly) be at the district.

Appendix Table I

Micro-production Function Studies of Formal and Non-Formal Education's Contribution in Agricultural Productivity

Country and Author	Sample	Analytic Method	Other than Schooling Factors in Equation	Effects of Schooling	Other than Non-Formal Education Factors in Equation	Effects of Non-Formal Education	General Findings and Comments
Philippines (Halim, 1976)	Subsample of a 1963 random sample of households in 28 representative barrios of Laguna district (n=2062) and subsequently resurveyed in 1968 (N=1536) and 1973 (N=428). No indication of how present subsample (N=274 in 1963, 273 in 1968, 220 in 1973) was selected. They are the same households for each year.	Cobb-Douglas production function.	1. Land area of rice cultivation 2. Number of laborers 3. Operating expenditures 4. Weighted number of extension contacts 5. Barrio development index 6. Dummy variables for extension	Average schooling of farm workers (adults and children) with rice production: in 1963, β= .020 ($p < .01$); in 1968, β= .019 ($p < .10$); in 1973, β= .027 ($p < .01$). Estimated contribution of schooling to increasing net farm earnings was non-significant.	1. Land 2. Labor 3. Operating expenditures 4. Family schooling	Extension contact with rice production in 1963, β= .00663 ($p < .01$); in 1968, β= .0036 ($p < .01$); in 1973, β= -.00017 (ns). Contact with "general extension approach" with rice production in 1968, β= .00171 ($p < .01$). Estimated contribution of specific extension practice to net farm earnings was non-significant. Overall rate of return to extension was 8.12 for each 5.69 invested.	Specific extension practices described, but difficult to relate to analysis. Measures in general were not well defined.
Taiwan (Wu, 1972)	Records of bookkeeping farms: 249 farms in 25 Hsiangs in 1964, 246 farms in 26 Hsiangs in 1965, 154 farms in 13 Hsiangs in 1966.	Cobb-Douglas production function.	1. Family labor-man day equivalents. (Female = 80% of male; child = 50% of male) 2. Value of farm owned land.	Schooling of household head with gross farm income, β= .024 ($p < .01$) for N=649. Schooling of household head with gross farm income - rice regions only, β= .007 (ns). Schooling of household head with gross farm income - other than rice, β= .035 ($p < .01$). Percent increase per year of schooling estimated at greater than 2%.	None	None	Simple rates of return to education are calculated, and are higher (89%) for other than rice, one year of education group than for 12 years of education group (29%).
	310 bookkeeping farms in 3 farming regions, 1964-1966.	Cobb-Douglas production function.	1. Labor input for crop production 2. Value of land 3. Capital services 4. Fertilizer expenses 5. Other expenses	Years of schooling^2 of farm operators with gross crop income, β= .005 ($p < .05$). Years of schooling of farm operators with gross livestock income, β= .035 ($p < .01$).	None	None	Comment: this study examines 2 forms of technical efficiency and 3 forms of allocative efficiency in both crop and livestock production. Schooling is found to improve all forms of efficiency.