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9. ABSTRACT

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Analyzes the costs of a regional non-formal education program aimed at the small farmer in Guatemala. The program seeks to help the farmers increase their production. Preliminary data drawn from the experience of the basic village education (BVE) project in the Oriente region of southwest Guatemala are evaluated. This analysis forms a part of the study of the relative cost-effectiveness of the separate delivery systems in the BVE project and of their benefit-cost analysis. Cash costs and economic costs are examined in the context of each of three models. The delivery systems for the models are: radio broadcasting (Model 1), radio broadcasts combined with personal contact by monitors (Model 2), and radio programs combined with personal contact by monitors and agronomists (Model 3). In future studies, the models will be applied to regions with a population of 500,000 persons evenly distributed across the geographic area, and in which there are six to a family with access to transportation facilities. Seventy-five percent of the population will listen to the radio on the average of 2.5 hours per day. The analysis will span two years from planning and project design, installation of equipment, and start of operations to the end of the project. The basis for the benefit-cost analysis will be the cost data derived from the studies of Models 1, 2, and 3. The value of the increased production minus the costs of the increased inputs is the context within which the benefits will be analyzed.

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A COST ANALYSIS OF A REGIONAL NON-FORMAL EDUCATION SYSTEM FOR SMALL FARMERS IN GUATEMALA

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Introduction

This paper analyzes the costs of a regional non-formal education program aimed at the small farmer in Guatemala. The Program is designed to help these farmers acquire knowledge and information which will change their attitudes towards, and increase their adoption of, improved agricultural practices. It is expected that these changes will reflect themselves in a general improvement in the quality of life within the target group.

The present paper is based on preliminary data drawn from the experience of the Basic Village Education (BVE) Project in the Oriente region of southwest Guatemala. Eventually this analysis will form a part of the study of relative cost-effectiveness of the separate delivery systems in the BVE Project, and of their benefit - cost ratios.

After analyzing existing cost data of the project, this paper utilizes costs which have been simulated or "scaled-up" to a regional level, taking into consideration anticipated economies of scale. The models used are based on the original design of the project; they consist of three distinct delivery systems, each with a different combination of radio transmission and direct personal contacts with farmers and farm groups. These combinations of "Message treatment" are described in detail elsewhere.2/

The paper contains: 1) a statement of the problem; 2) a description of the methodology employed; 3) presentation of the data, 4) an explanation of how the data will be employed in a later benefit-cost analysis; and 5) some conclusions.

The Problem

The analysis attempts to answer the question, posed by a Guatemalan planning official, "What would it cost to implement any one of the three non-formal education systems at the regional level in Guatemala?". The delivery systems are: radio broadcasting (Mo-

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1/ The writers are an agricultural economist and field supervisor for the BVE Project.

2/ Academy for Educational Development, June, 1975. Mixes of Communications Media Utilized in the Project. Guatemala City, Guatemala. Preliminary Mimeo Report, un-numbered.

del I), radio broadcasts combined with personal contact by monitors (Model II), and radio broadcasts combined with personal contact by monitors and agronomists (Model III). It should be emphasized that each model is "freestanding", and independent of the other two. The costs will appear to be accumulative in nature only because of the initial project design. Eventually, other models will be employed (i.e. Monitor only) that will more appropriately illustrate the non-accumulative nature of the costs.

The models will be applied to a region with the following characteristics: 1. A population of 500,000 persons, 6 to a family evenly distributed across the landscape, with access to transportation facilities. 2. Seventy five percent of the population listen to the radio an average of 2.5 hours per day. These data closely resemble conditions found in three Departments of southeastern Guatemala where the present experimental program is in operation.

Methodology

The costs will be stated in terms of both cash and economic costs. The cash costs are simply the expenditures that would be required to implement any one of the three models. The economic costs differ from the cash costs in the following aspects. First, the cash costs do not include overhead to the extent that the program could be implemented by a Ministry without expanding its facilities. However, the economic costs do include an overhead charge to reflect the alternative uses, or "opportunity costs", of the resources that are employed by the Ministry to backstop the project. This procedure assumes: 1) that there is opportunity within a given Ministry to utilize its current limited resources more intensively; and 2) that decisions must be made concerning distribution of those resources among various projects (hence the "opportunity costs".)

Cash costs reflect expenditures for capital items in the first year, while the economic costs are spread over th e useful life of the item. In this case, the economic costs will tend to be less than the cash costs.

The time frame of the analysis is two years. During the first year, the start-up activities of the project are carried out; such as planning and project design, and installation of equipment. From conception to operation, the RVE project took longer than two years, but the experience gained should permit subsequent projects to be implemented in a much shorter period of time. At the beginning of the second year, the project starts operations, and continues until the end of the year.

The methodology employed to compute costs follows that developed by Dean Jamison and Steven Klees in The Cost of Instructional Radio and Television for Developing Countries (Academy for Educational Development, Washington, 1973). There are two slight departures from the Jamison-Klees approach. First, different cost categories were used to conform with the basic design of the Project. Second, while Jamison and Klees refined their costs to a per student per hour basis, RVE costs are stated in terms of the costs per farmer exposed to a particular informa-

tion delivery system (Models I, II or III).

The difference in the time dimensions reflects the differences in formal and non-formal education. While cost per student per hour may accurately describe a situation where education is bought to a fixed audience on a regular basis, it does not describe the system employed in the BVE. The BVE non-formal systems enter the small farmer's stream of consciousness at different intervals, for different periods of time and with different degrees of intensity. Radios may be listened to carefully, or in a relaxed manner. Agronomists will reach some farmers indirectly through the use of demonstration plots, and others on a one-to-one basis. Monitors work with both groups and individuals. Therefore, the most appropriate means to describe the effect of the models is in terms of the total number of farmers exposed, on a continuing basis.

Model I

Model I is a system that reaches farmers by broadcasting a variety of radio programs 6 days a week. The number of farmers exposed to Model I is calculated as follows:

1. $P \times R = L$ where;

   P is the total population
   R is the listening rate,
   L is the population listening.

2. $L/S = F$ where,

   S is the number of persons per family
   F is the number of heads of families (farmers) listening.

Moreover, the calculations assume that each farmer listens 2.5 hours a day 6 days a week. All of these data are drawn from the initial experiences of the BVE project in the Oriente of Guatemala.

Table 1 (P.7) shows the costs of Model I from the start up through the first year of operation. Categories 1, 2, and 3 are self explanatory. Category 4, Message Content, includes the costs incurred in deciding what information should go into a message. Category 5 is the cost of assesing the impact of the messages through various feedback mechanisms. Category 6 represents the costs of producing and delivering the messages after the content is decided upon.

Category 6 includes the costs that farmers spend on batteries in listening to the radio. Once the radio station is established and broadcasting, this is the only variable cost of exposing additional farmers to the system. The variable costs do not include depreciation, nor maintenance of radios on the grounds that farmers already own radios. One could consider that the battery costs of farmers are not substantial on the grounds that farmers already listen to the radio and merely substitute one program for another. However, it was decided to include battery costs to avoid

overlooking a major cost item. The battery costs were calculated as follows:

1) B/L = H when:

B is the cost of a set of new batteries
L is the hours of life for a set of batteries
H is the cost of using the batteries per hour.

Then,

2) H x Y = C where;

Y is the hours of listening per year
C is the cost per family per year.

These cost estimates were drawn from the experimental program. It should be noted that battery costs can become a large amount reaching $170,625 in the case of 62,500 families listening. On a large scale project, a logistic system might be developed for the use of rechargeable batteries with substantial cost savings.

Table 2 (P. 8) presents an analysis of how the total number of families listening affects the per unit costs. As would be expected where the costs of the radio are largely fixed, the per unit cost decreases sharply with an increase in the size of the audience.

Model II

Model II is a system that reaches farmers by radio broadcasts and with a personal contact system utilizing monitors. The total number of families reached by the complete system (radio and monitors) is assumed to be 31,250 at the onset. In addition to these families, the remainder in the region are assumed (based on BVE experience) that one monitor could serve 170 families.

Table 3 (P. 9) illustrates the costs of providing radio and monitor to 31,250 families, and radio alone to the remaining 31,250. Table 4 (p. 10) shows an analysis of how the total cost is affected by the number of families receiving the complete package. The per unit costs cannot be displayed except where total saturation is achieved. At any point prior to total saturation, the number of farmers receiving the complete package (Radio plus monitor) and the partial package (radio only) will not be the same units. Therefore, to state the per unit costs would be mixing apples and oranges. However, at the total saturation level (62,500 families) the units converge, and it is possible to state per unit costs.

Model III

Model III is a system that reaches farmers through two treatments; radio and personal contact with monitors and agronomists. The agronomists are assumed (based on BVE experience) to be able to serve 600 families.

Table 5 (p.11) demonstrates the costs of reaching 31,250 families with complete package of model III and the remaining 31,250 with radio only. Table 6 (p.12) is an analysis of the costs of the total package at different levels of exposure. Tables 5&6 can be directly compared to tables 3 and 4.

Relation to the Benefit - Cost Analysis

The cost data for Models I, II and III will ultimately form the basis for the benefit-cost analysis of the three alternatives. As the BVE project progresses, improved cost data will be generated, but the basic format will remain the same.

In simulating the benefits, the farmers reached by the delivery systems of Models I, II and III will be treated as "students", some of whom will acquire new knowledge, change their attitudes and adopt new practices. The probabilities of this process occurring will be established by the BVE Project.

Upon adopting new practices, it is expected that farmers will increase production, and will also increase their costs. The benefits of the delivery systems of the different models will be the value of the increased production minus the costs of the increased inputs, with a value imputed to the farmer's labor where appropriate. The "student-farmers" cannot be expected to change practices immediately. Hopefully, increased production will result as early as the third year of a program. Meanwhile, the costs begin in the first year. Therefore, the costs and benefits will be stated in terms of present value, with an appropriate lag (again based on BVE experience) before the increase in production. At some point in time, the costs of the program will be assumed to decrease substantially.

Using the "student-farmer" analogy, a farmer has "enrolled" when the delivery system begins. When farmers adopt new practices, they will have "graduated" and will increase their income. After they "graduate", their educational costs will decrease sharply. In the process of being educated, some will "fail". There will be a dropout rate. Those that do not elect to listen to the radio, now work with monitors and/or agronomists will never have "enrolled".

In the final analysis, the benefits of a non-formal education program will be compared with the costs to determine if it is a feasible use of public funds. Also, a cost-effectiveness analysis will be conducted to determine which delivery system is the most efficient.

Conclusions

The cost data of Tables 2, 4 and 6 show that, at maximum program exposure, costs of Models II and III are approximately 2.5 and 3.4 times the cost of Model I, respectively. That proportionality does not hold at lower exposure levels, however, due largely to differences in fixed and variable costs as shown in Table 7.

Model I has high fixed costs and low variable costs. Models II and III have only slightly more fixed costs, but the variable costs rise sharply.

In terms of planning from the cost standpoint, Model I might be ideal for a situation where budget uncertainty reigns. Once the radio delivery system was installed and functioning, the cost of extending the coverage would be small. On the other hand, models II and III would require larger expenditures to extend coverage.

Ideally, the final judgment will rest on the comparisons of benefits and costs.

Table 1. Simulated cash and economic costs during the start-up period and first year of operation for a regional non-formal education system designed to bring agricultural information to small farmers by means of radio (Model I). 1/

Category	Costs	
	Cash (U.S. $)	Economic (U.S. $)
1. Feasibility Studies	27,754	27,754
2. Project Design and pre-planning	70,323	82,822
3. Administrative costs	154,486	177,137
4. Message content	63,128	70,707
5. Message Appraisal	34,421	39,359
6. Radio Delivery System		
a. Pre-production	52,286	61,111
b. Production	33,683	33,797
c. Delivery	239,789	217,525
7. TOTAL COSTS	675,870	710,212

1/ Based on a total number of 62,500 farmers exposed.

Table 2. Simulated economic costs of Model I with different numbers of farmers exposed.

No. of Farmers Exposed to Radio (N_1)	Total Economic Costs (TC_1) 1/ (U.S. $)	Cost per farmer exposed (TC_1/N_1) (U.S. $)
0	539,596	0
6,250	556,658	89.06
12,500	573,721	45.89
18,750	590,783	31.51
25,000	607,845	24.31
31,250	624,907	20.00
37,500	641,969	17.12
43,750	659,031	15.06
50,000	676,093	13.52
56,250	693,155	12.32
62,500 2/	710,212	11.36

1/ Based on the cost function: $TC_1 = 539,596 + N_1$ (2.73) where:
TC_1 = total economic cost.
N_1 = No. of farmers exposed to radio

2/ Base number of farmers exposed.

Table 3. Simulated cash and economic costs during the start-up period and first year of operation for a regional non-formal education system designed to bring agricultural information to small farmers by radio and personal contact by monitors. (Model II). 1/

Category	Costs	
	Cash (U.S. $)	Economic (U.S. $)
1. Feasibility studies	27,754	27,754
2. Project design and Pre-planning	70,323	82,822
3. Administrative costs	154,486	177,137
4. Message Content	63,128	70,707
5. Message Appraisal	34,121	39,359
6. Radio Delivery System		
a. Pre-Production	52,286	61,111
b. Production	33,683	33,797
c. Delivery	240,334	217,534
7. Personal contact Delivery System		
a. Pre-Production	12,122	13,464
b. Production	14,015	11,921
c. Delivery	550,386	515,825
8. TOTAL COSTS	1,252,938	1,251,431

1/ Based on total number of 31,250 farmers exposed to the radio and personal contact system, and another 31,250 receiving radio alone.

Table 4. Simulated economic costs of Model II with different numbers of farmers exposed to complete package (Radio Monitor).

No. of Farmers Exposed to total package (N_2).	No. of Farmers Exposed to radio only. (N_3)	Economic Total Costs (TC_2) 1/ (U.S. $)	Cost per farmer exposed (U.S. $)
0	62,500	735,606	-
6,250	56,250	838,730	-
12,500	50,000	941,854	-
18,750	43,750	1,044,978	-
25,000	37,500	1,148,102	-
31,250 2/	31,250	1,251,227	-
37,500	25,000	1,354,350	-
43,750	18,750	1,457,474	-
50,000	12,500	1,560,598	-
56,250	6,250	1,663,722	-
62,500	0	1,766,846	28.27

1/ Based on the cost function: $TC_2 = 564{,}981 + N_2\ (19.23) + N_3\ (2.73)$ where:

TC_2 = total economic cost
N_2 = No. of farmers exposed to both radio and personal contact.
N_3 = No. of farmers exposed to radio only

2/ Base No. of farmers exposed.

Table 5. Simulated cash and economic cost during the start-up period and first year of operation for a regional non-formal education system designed to bring agricultural information to small farmers by radio and personal contact by monitor and agronomist (Model III). 1/

Category	Costs	
	Cash (U.S. $)	Economic (U.S. $)
1. Feasibility Studies	27,754	27,754
2. Project Design and Pre-planning	70,353	82,822
3. Administrative Costs	154,486	177,137
4. Message Content	63,128	70,707
5. Message Appraisal	34,121	39,359
6. Radio Delivery System		
a. Pre-Production	52,286	61,111
b. Production	33,683	33,797
c. Delivery	240,432	217,647
7. Personal Contact Delivery System		
a. Pre-Production	12,122	13,464
b. Production	14,015	11,921
c. Delivery	917,068	838,405
8. TOTAL COSTS	1,619,718	1,574,124

1/ Based on a total number of 31,250 farmers exposed to the radio and personal contact system, and another 31,250 receiving radio alone.

Table 6. Simulated Economic costs of Model III with different numbers of farmers exposed to the complete package (Radio, monitor and agronomist).

No. of Farmers exposed to total package (N_4)	No. of farmers exposed to radio only (N_5)	Total economic costs (TC_3) 1/ (U.S. $)	Cost per farmer exposed (U.S. $)
0	62,500	735,606	-
6,250	56,250	903,231	-
12,500	50,000	1,070,856	-
18,750	43,750	1,238,481	-
25,000	37,500	1,406,106	-
31,250 2/	31,250	1,573,731	-
37,500	25,000	1,741,356	-
43,750	18,750	1,908,981	-
50,000	12,500	2,076,606	-
56,250	6,250	2,244,231	-
62,500	0	2,411,856	38.59

1/ Based on cost function: $TC_3 = 564,981 + N_4\ (29.55) + N_5\ (2.73)$ where:

TC_3 = total economic cost
N_4 = No. of farmers exposed to both radio and personal contact
N_5 = No. of farmers exposed to radio only

2/ Base number of farmers exposed.

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Table 7. Fixed costs and variable costs per farmer exposed to the three delivery systems (Models I, II, and III) for a non-formal education system for small farmers in Guatemala.

Model	Fixed costs (U.S. $)	Variable cost per farmer 4/ (U.S. $)
I 1/	539,596	2.73
II 2/	564,981	19.23
III 3/	564,981	29.55

1/ Model I is radio only

2/ Model II is radio plus monitor

3/ Model III is radio, monitor, plus agronomist

4/ The unit costs of extending the coverage of the system to include more farmers