DOCUMENT RESUME

ED 074 100 TM 002 463

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TITLE Systems Analysis for Program Planning and Cost Effectiveness. (An Application).
PUB DATE 73
NOTE 21p.; Paper presented at the annual meeting of the American Educational Research Association, February 1973

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS *Cost Effectiveness; Educational Objectives; Elementary Grades; *Program Budgeting; Program Evaluation; *Program Planning; Resource Allocations; School District Spending; Speeches; *Systems Analysis

ABSTRACT

This paper describes an effort to implement a cost-effectiveness program using systems analysis in an elementary school district, the Rio Linda Union School District in California. The systems design cycle employed has three phases, policy-making evaluation, and action-implementation. During the first phase, the general philosophy or mission of the organization is described, the goals and objectives are established, their priorities are ordered, and the alternative programs to meet those goals and objectives are generated. During the second phase, the relative worth of the various alternatives is determined, and the objectives' attributes and their measures of effectiveness are established. During the third phase, the programs to be implemented are chosen from among the alternatives, put into effect, evaluated, and the results fed back into the next planning cycle. Problems in communication with teachers and coordinators and in overcoming resentment of the approach are discussed. One of the major successes of these efforts to implement cost-effectiveness and program budgeting in this school district is that the goals and objectives of the education process are defined clearly at all levels. Systematic planning and evaluation of costs and effectiveness also brings about greater dialog among the parties involved and more concern for planning program alternatives. (KM)

SYSTEMS ANALYSIS FOR PROGRAM PLANNING AND COST EFFECTIVENESS

(An Application)

By

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Presented at the 1973 Annual Meeting of the
American Educational Research Association
February 25, 1973 to March 1, 1973
New Orleans, Louisiana

INTRODUCTION

This paper describes an effort to implement a cost-effectiveness program using systems analysis in an elementary school district. Rio Linda Union School District in California requested the authors' assistance after the California State Board of Education mandated that each school district plan and budget by the Fall of 1973 according to a Program Planning and Budgeting System (PPBS). However, the mandate has not been enforced for reasons which will be discussed later.

The superintendent and his staff at Rio Linda had explored program budgeting to the point where they were ready to involve all the district administrators and supervisors. They were also opening a school constructed and operated with new concepts and wanted some way to measure its effectiveness. The paper describes the systems design cycle employed and includes the first goals and objectives which were developed as well as the models for evaluating alternative programs. It also describes the problems encountered and successes claimed.

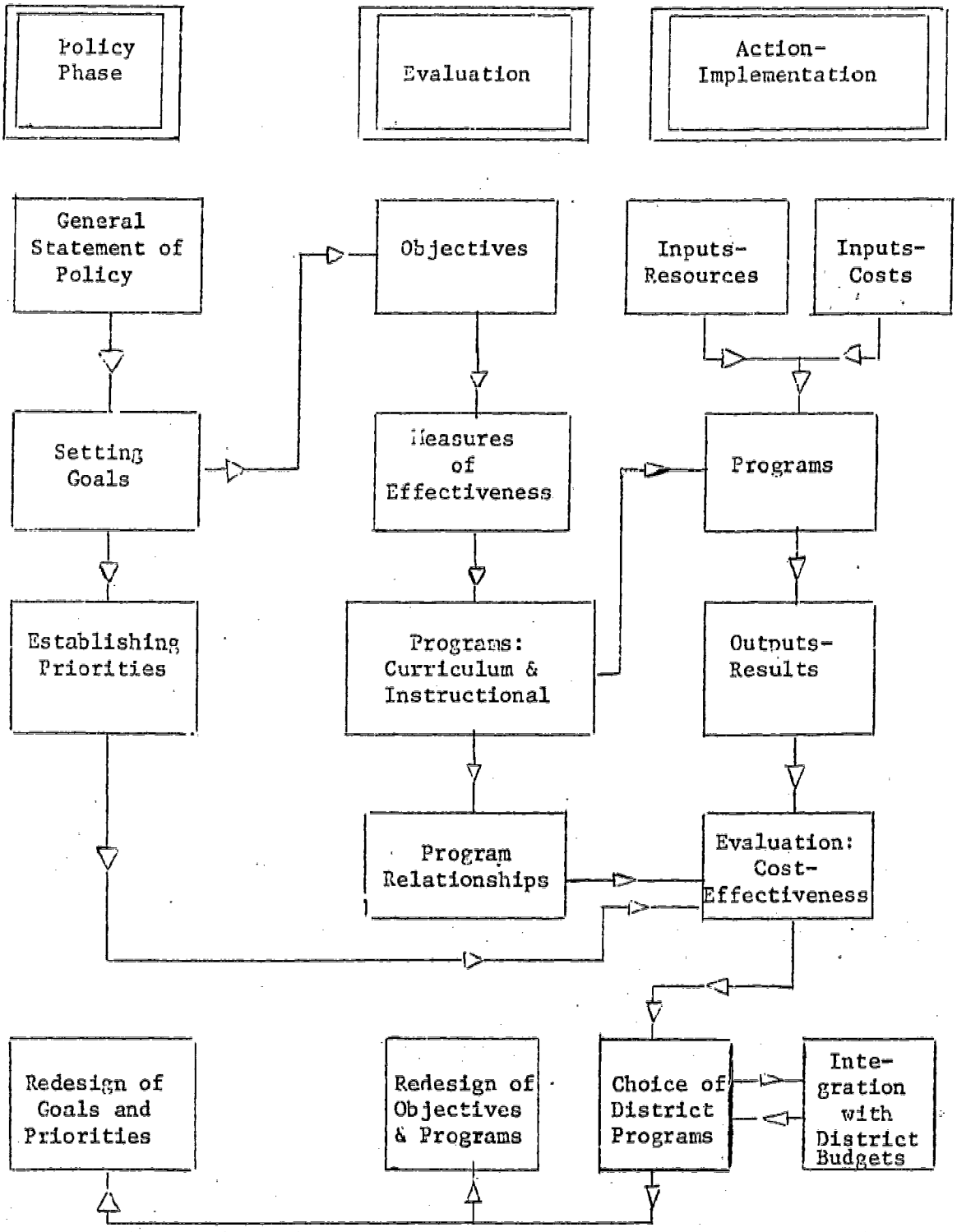
THE SYSTEMS DESIGN CYCLE

The Overall Process

The District administrative and supervisory staff and the consultants (authors) discussed the framework for cost effectiveness planning and evaluation of the system design cycle which is shown in Figure 1. It illustrates the three phases of the cycle: (1) Policy-making, (2) Evaluation, (3) Action-implementation.

FIGURE 1

FRAMEWORK FOR A COST - EFFECTIVENESS EVALUATION[1]



During the first phase the general philosophy or mission of the organization is described, the goals and objectives are established, their priorities are ordered and the alternative programs to meet those goals and objectives are generated. During the second phase the relative worth of the various alternatives is determined and the objectives' attributes and their measures of effectiveness are established. During the third phase, the programs to be implemented are chosen from among the alternatives, put into effect, evaluated and the results fed back into the next planning cycle.

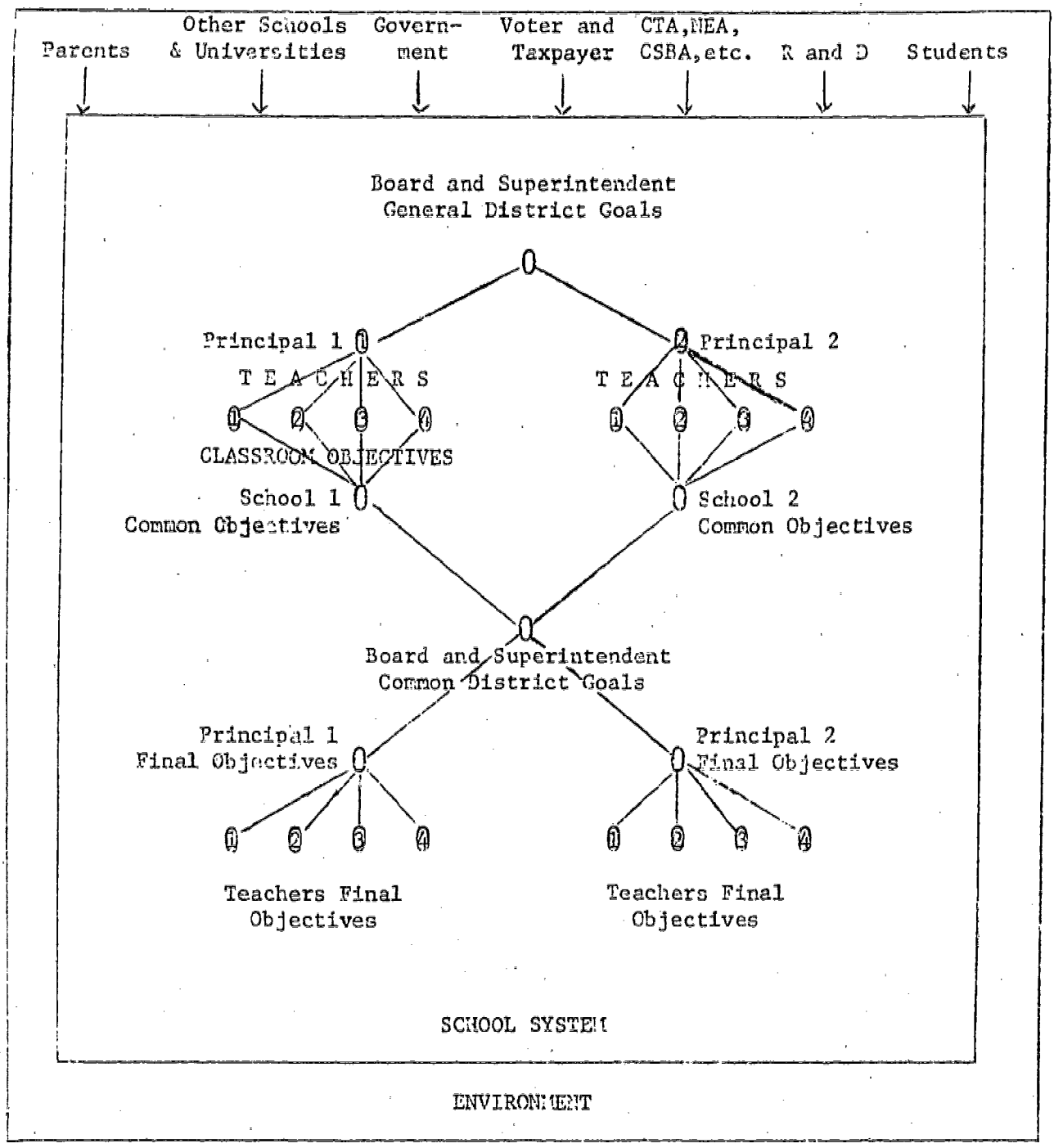
The Goal and Objective Setting Process

The School Board may state a desire, a staff man may do the work but the superintendent must take the lead and obtain agreement on the general mission and broad goals from all the groups in the system: teachers, administrators, board, parents, taxpayers and government. The teachers and administrators must then agree on the more specific objectives with the approval of the board. Many studies have verified that an organization of professional people generally functions more effectively if its members have a voice in setting the goals and objectives. In addition, the goals of the individuals and of the sub-units become better integrated with those of the whole organization: The goals are more realistic and the individuals are more committed to achieving them.

Figure 2 illustrates the goal-setting process. The superintendent determines the broad goals of his district with the approval of the board taking into account constraints imposed by the parents, other schools,

FIGURE 2

GOAL SETTING PROCESS IN A SCHOOL SYSTEM[2]



the government, the voters and taxpayers, professional associations and labor unions, students and technology available. To the extent the citizens in the community are interested, they should be involved in the goal-setting process. In some districts like Hillsborough, California, the citizens are very active.[3] In other districts, it is difficult to involve them.

The superintendent communicates the broad goals through the principals to the teachers. Then the teachers individually and collectively propose classroom goals while the principal proposes school goals. The two are modified and integrated into a set of common school goals. Then the principals, individually and collectively, propose these goals to the superintendent who establishes district goals which, in turn, become the district program for the period.

The hierarchy of goals and objectives initially proposed at Rio Linda were as shown in Figure 3. The statement of philosophy or mission, often considered as broad as "God" and "Motherhood", must be carefully defined because it points the system's direction and boundaries. For example, the officers of one of the nation's largest railroads for years thought of themselves as in the railroad business--with some reason. Then one day they realized they had some trucks and pipelines and redefined their mission as being in the transportation business. As a result, more effort and resources were put into other profitable modes of transportation besides the railroad.

The goals to implement the Rio Linda Mission were a composite of its goals, those of other school districts and the California School Boards

FIGURE 3

NETWORK OF POSSIBLE GOALS AND OBJECTIVES - RIO LINDA UNION SCHOOL DISTRICT[4]

Philosophy or Mission	General Goals	Sub-Goals	Objectives by Classes and Individuals: Minimums & Maximums
Educate K - 6 Effectively and Efficiently: Transmit Culture and Certain Skills, Optimize Individual Development	Develop Communication Skills	Reading, Writing, Viewing, Listening, Speaking	Skill Level Each Period
	Develop Content and Process Skills	Arithmetic, Science	Skill Level Each Period
	Develop Understanding of Rights and Obligations & Moral Values of Citizens in a Democracy	Social Studies	Skill Level Each Period
	Encourage Creative Appreciation	Art, Music, Literature	Skill Level Each Period
	Develop Physical Health	Hygiene, Strength, Coordination	Capability Each Period
	Develop Mental Health & Self Discipline	Social Adjustment, Self Control, Inner Well Being	Behavioral Change Each Period
	Develop Interaction Skills	Awareness, Sensitivity, Perception, Courtesy, Teamwork	Behavioral Change Each Period
	Encourage Creative Expression	Observing Power, Inquiring Power, Experimental Design	Skill Level Each Period
	Develop Desire to Learn		Initiate Own Program

Association.[5] The layman and the professional would probably agree that these goals are, for the most part, in their proper order of rank with the most difficult to measure being at the bottom of the list. However, to rank them according to the Systems Design Model, cost effectiveness of alternative programs would have to be developed first. In any budget cycle, money always runs out before programs to accomplish goals at the bottom of the list are funded. However, in the next cycle the changing environment may demand a re-ranking. In addition, some programs are directed toward more than one goal. For example, a physical education program may be directed not only towards the physical health goals but also towards the mental health and interactive skills goals.

Program Generation and Analysis*

To help accomplish the general goals of developing communication skills and an understanding of the rights, obligations and moral values of a citizen in a democracy, a program in Spanish might be suggested. The sub-goals are teaching children to read, write, and speak Spanish and to understand the Spanish speaking countries' culture compared to ours. What alternative programs can be employed to meet these sub-goals? At this point the appropriate teachers and supervisors can brainstorm the alternatives and note the resources required. They might employ the model shown in Figure 4. To determine what each program costs, they might use the model shown in Figure 5.

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*This particular program is a hypothetical one which was not generate at Rio Linda but was used by the consultants to demonstrate to their clients the use of the model for program analysis.

FIGURE 4

PROGRAM RELATIONSHIP[6]

PROGRAMS VS. SPECIAL NEEDS

	Special Library Materials	Tapes & Audio-Visual Equipment	Organization of Visits	Locating Suitable Homes for Internship
Prog. 1: Classroom Instruction	X			
Prog. 2: Classroom & Laboratory	X	X		
Prog. 3: Laboratory & Visits		X	X	
Prog. 4: Internships			X	X

PROGRAMS VS. PERSONNEL

	Regular Teacher	Special Teacher	Outside Coordinator	Administrator, Principal, Etc.
Prog. 1: Classroom Instruction	X	X		
Prog. 2: Classroom & Laboratory	X	X		
Prog. 3: Laboratory & Visits		X	X	X
Prog. 4: Internships			X	X

PROGRAMS VS. BUDGETS

	Salaries Budget	Fixed Charges Budget	Special Facilities Budget	Outside Activities Budget
Prog. 1: Classroom Instruction	X	X		
Prog. 2: Classroom & Laboratory	X	X	X	
Prog. 3: Laboratory & Visits			X	X
Prog. 4: Internships				X

FIGURE 5

INPUTS - RESOURCES AND INPUTS - COSTS FOR EACH PROGRAM ALTERNATIVE[7]

Inputs - Resources	Inputs - Costs			
Personnel	Program 1	Program 2	Program 3	Program 4
Teachers Salaries	$_____	$_____	$_____	$_____
Fixed Charges	$_____	$_____	$_____	$_____
Specialist, Salary & F.C.	$_____	$_____	$_____	$_____
Allocation, percent of one Principal	$_____	$_____	$_____	$_____
Allocation, percent of one Coordinator	$_____	$_____	$_____	$_____
Supplies and Materials				
Texts	$_____	$_____	$_____	$_____
Records & Tape Recorders	$_____	$_____	$_____	$_____
Language Lab Equipment	$_____	$_____	$_____	$_____
Miscellaneous Supplies	$_____	$_____	$_____	$_____
Transportation				
Bus for six visits to Cultural Center	$_____	$_____	$_____	$_____
Organized Visits				
Contract for visits related to foreign culture	$_____	$_____	$_____	$_____
	$_____	$_____	$_____	$_____
TOTALS	$_____	$_____	$_____	$_____
	$_____	$_____	$_____	$_____

Costs and all allocations can be further refined by specifying budget classifications, etc.

Evaluation Planning Process

With the above data, the planners have the "cost" half of the cost-effectiveness fraction. What about the "effectiveness" half? The evaluation phase of the Systems Design Cycle seeks to translate the goals into specific objectives which can be evaluated. Objectives are expressed in measurable attributes. An attribute is a factor or variable by which specific objectives can be identified. An attribute and its measure of effectiveness determine the objective. For example, to obtain the sub-goals of learning the Spanish language and culture we might set out the following objectives:

OBJECTIVES[8]

Objective	Attribute	Measure of Effectiveness
1	Reading Ability	A native speaker should be able to understand a sixth grade pupil reading a 200-word article in the language in question.
2	Writing Ability	A sixth grade pupil should be able to write short sentences in the language and rate a C grade when compared to an average class.
3	Speaking Ability	A sixth grade pupil should be able to express short sentences in the language without help of a reading text and be understood by a native speaker.
4	Counting Ability	A sixth grade pupil should be able to count numerals up to 1000 in the foreign language without hesitancy.
5	Knowledge of Culture	A sixth grade student should be able to describe the culture of one country related to the foreign language in question. Culture will be defined as customs, history, and other significant traits.

6	Understanding Relationships	Knowledge of a foreign language is useless unless the student understands how his country relates to other countries where the language is spoken. The student will be tested on his knowledge of customs and geographical facts which may influence the U.S. and vice versa.

Which program most effectively meets the objectives? In Figure 6 the planners intuitively weigh the objectives in terms of what they think they want to accomplish and distribute the weights among the four programs. It turns out that program #4 is both the least costly and the most effective. However, on further investigation the planners learn there are insufficient community resources to make internships feasible. Therefore, they look at programs #2 and #3. Program #2 is cheaper but #3 is more effective and for $10,000 more, the planners opt for program #3.

Implementation and Evaluation

The analysis and evaluation of possible Spanish programs is completed. Now the staff must compare the Foreign Language Program versus others accomplishing a variety of goals. In terms of cost and effectiveness, planners may well find that Spanish communication skill and understanding will rank of less importance than other competing programs.

Educational programs cannot be evaluated solely on the basis of "hard" evidence such as can be done to measure the strength of a steel column in mechanics or the profitability of a cost reduction on sales programs in private industry. Evaluation of the results of education must still allow for subjective assessments on the part of teachers of the effects of programs on pupils. In addition, the degree of importance and/or

FIGURE 6

Attribute	Weight	Program 1	2	3	4
Reading	6	6	4	2	3
Writing	3	3	1	1	2
Speaking	10	6	8	4	10
Counting	8	6	8	8	6
Knowledge of Culture	10	4	4	8	10
Understanding Relationships	10	4	4	8	10
Total Points:		29	29	31	41
Program Cost Per Year:		$220,000	$320,000	$330,000	$206,000

ranking among programs is subject to the political necessities of the situation at any particular moment in time.

When all the cost-effectiveness evaluations and jugglings are completed within the constraints of the available resources, the accountant can total his program budgets into his total district budget, notify the program administrators and set up controls to watch the flow of expenditures against the programs. Figure 7 summarizes the cycle.

At the end of the established time period, the attributes must be measured then determined whether or not the objectives have been met and, if not, why not? Whatever is learned from the evaluation will be used as inputs into planning the next cycle of goals and objectives.

THE PROBLEMS ENCOUNTERED AND SUCCESSES CLAIMED

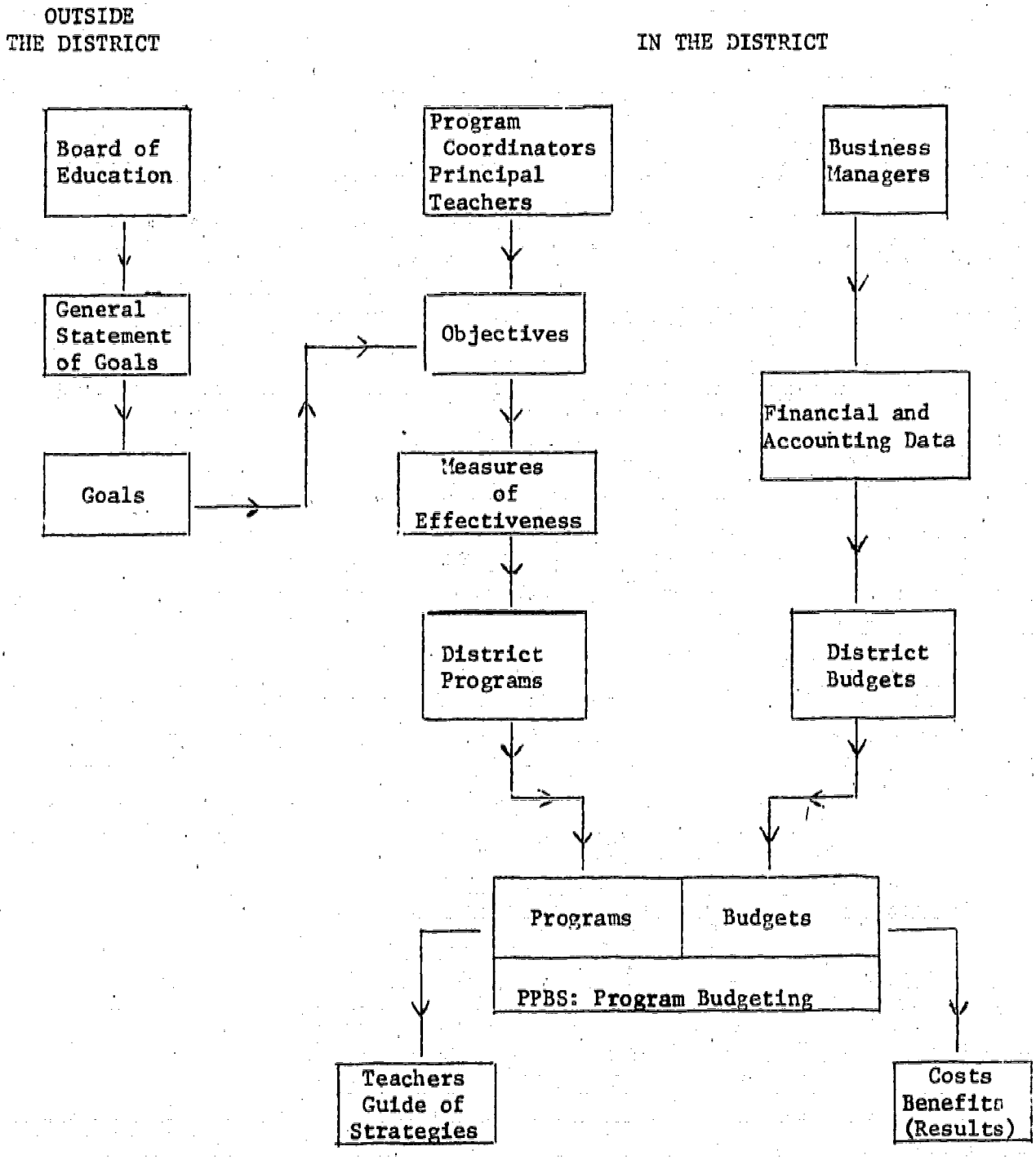
Problems

The implementation of PPBS in all of California school districts has been halted by a legislative resolution pending further hearings and investigation.[10] This event is most discouraging in the light of the great deal of time and effort which Rio Linda and other districts have devoted to meeting the original PPBS implementation deadline. The stay was justified for various reasons; one group supporting it feared that PPBS was a "communist plot"!

Implementation of a program such as a program planning and budgeting system is hampered by the amount of time that the people at all levels--from teachers to the board and even the community--must devote to its inception. Those in authority must request that time be allocated to it.

FIGURE 7

FINAL INTEGRATION OF PROGRAMS AND BUDGETS TOWARD PROGRAM BUDGETING[9]



Otherwise, the planning job breaks down for lack of communications among all levels of the system.

Initially, the authors had difficulty communicating with teachers and coordinators although no communication barrier was detected between them and the top level administrative and business staff. Teachers and coordinators did not understand the words we used (educators and businessmen have their own jargon), and at first, they did not follow the logic of the goals, objectives and programs' hierarchy. They worried about exact definitions until we explained it really did not matter if they called "goals" "objectives" or vice versa.

Many teachers thought in terms of the classroom reading program and art program as being "good" in themselves without tying them back to the goals and mission of the education system. Some resented attaching dollar signs to such "good" things as "creative appreciation" and "sensitivity". Others felt the whole program was being "stuffed down their throats by administration." It took awhile before we could talk the same language and get to the point where we could begin to set objectives.

Successes

Regardless of how various factions and groups may feel about the impact of program budgeting, one thing is certain: It brings the goals and objectives of all the agents involved in the education process into focus--the public, the pupils, the legislators, government officials, administrators, teachers, non-teachers, and parents.

The Rio Linda Union School District is emphatic in pointing out that one of the major benefits of efforts to implement cost-effectiveness and program budgeting is that the goals and objectives of the education process are defined clearly at all levels. The District has had to formulate goals and objectives which reflect:

(1) the desires of the community, i.e, parents and public;

(2) the dictates of the California State Board of Education and of the legislature; and

(3) the opinions of the teachers.

Also, it is apparent from the District's Annual Report that the administration sets targets from year to year and measures the extent of its achievement, a procedure which had not been formalized previously and which provides valuable information for future planning.

Before the implementation of PPBS, the teachers ran many programs for which they were hard pressed to find clear purposes. This became obvious during the early discussions on the subject even on important programs such as reading, physical education and mathematics. Most teachers were eager to get involved in the decision-making process and expressed great satisfaction in clarifying the purposes of their programs and participating in making school policy. Teachers' involvement in curriculum planning increased considerably.

Whether goals are used as inputs for PPBS or not, the process by which they evolve has been thoroughly beneficial. Through increased participation, the community, parents and teachers have gained influence and power.

The role of the teacher has benefited from:

(1) increased opportunity and interest in getting involved in the planning and designing of objectives and programs;

(2) improved consensus in what they are trying to achieve; and

(3) increased teacher participation in Certificated Education Councils and other professional associations such as the California Teachers' Association.

The role of the teacher has been influenced by:

(1) pressure from the public at large to obtain improved cost effectiveness of education, and

(2) legislative mandate to measure not only teacher competence but teacher effectiveness (more about this later).

As a result of a more systematic formulation of goals and objectives at all levels where PPBS has been initiated:

(1) Programs are better designed.

(2) Teachers have become more "goals" and "programs" oriented.

(3) A more systematic procedure for program development is being followed.

(4) When new programs are created, a "project management" type of organization has evolved which superimposes horizontal organization forms which cut across the traditional vertical hierarchal structure.

(5) To a certain extent, teachers have gained increased decision-making power in designing curriculum changes and programs.

(6) A greater regard has evolved for considering and selecting program alternatives with the best payoff.

Improved program evaluation has also occurred as the result of other requirements such as those imposed by the Stull Bill.[11] This bill directs

district boards to develop evaluation and assessment guidelines and procedures which must include the following elements (apparently, this evaluation is not "communist" inspired):

(1) Teacher Competence - "Assessment of certificated personnel as it relates to the established standards" and "Assessment of other duties normally required...as an adjunct to...regular assignments."[11]

(2) Student Progress - "The establishment of standards of expected student progress in each area of study and of techniques for the assessments of that progress."[11]

(3) Student Control - "The establishment of procedures and techniques for ascertaining that the certificated employee is maintaining proper control and is preserving a suitable learning environment."[11]

The accomplishment of the intent of the Stull Bill has required that teachers and administrators set objectives and measures of their achievement, similar to those that are demanded by PPBS. Standards of pupil progress and growth expectations are being established for most skill areas.

CONCLUSIONS

The whole educational process is undergoing important changes, not the least of which is the preoccupation of those footing the bill with "getting their money's worth." These efforts have sparked renewed interest in methodologies such as the Systems Approach or Systems Analysis, PPBS and others which promise systematic planning and evaluation of costs and effectiveness. An investigation in the results obtained to date point to the following gains:

(1) There is a greater dialogue among all parties involved in education regarding what should be done. Increased dialogue should lead eventually to higher consensus and motivation.

(2) There is more concern for planning program alternatives which meet the objectives in order to allocate resources to those which best satisfy the needs of the recipients.

(3) In the end, the pupils, and through them, the public, should be the direct beneficiaries of better programs, better schools, and better education.

FOOTNOTES

1. John P. van Gigch and Richard E. Hill, Using Systems Analysis to Implement Cost-Effectiveness and Program Budgeting in Education. Englewood Cliffs, New Jersey, Educational Technology Publications, Inc., 1971. P. 29.

2. Op. cit., p. 17.

3. Tod A. Anton, "PPBS: Experience of a Pilot District." Hillsborough, California, Hillsborough City School District Office Memorandum, 1972. P. 3.

4. John P. van Gigch and Richard E. Hill, op. cit., p. 21.

5. California School Boards Association, "Educational Goals and Objectives in California." School Instructional Program Committee, Sacramento, California, August, 1969.

6. John P. van Gigch and Richard E. Hill, op. cit., p. 39.

7. Ibid., p. 43.

8. Adapted from Hillsborough City School District, Planning, Programming, Budgeting Systems: Goals, Objectives and Programs. Hillsborough, California, 1969-1970.

9. John P. van Gigch and Richard E. Hill, op. cit., p. 47.

10. California State Assembly Concurrent Resolutions ACR 98. August 1, 1972.

11. California State Legislature Assembly Bill No. 293. Approved July 21, 1971. Excerpted from Article 5.5.