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Overview of Research

Research question

The purpose of this study is to address the research question "Given a number of villages, how would one go about ranking them as to priority for improvement of the water supply?"

Improvement of the quality and quantity of water supplies in rural villages is a priority investment in developing countries; however, a review of the literature generally indicates that few countries have programs that are replicable, and that many services provided to date have been abandoned or underutilized. Since the purpose of a site selection procedure is to identify the villages that are most likely to satisfy the objectives of a water supply program, improvement of the site selection process can be expected to result in more successful projects.

General agreement in the literature exists on the objectives

of water supply improvement. Uncertainty is present, however, regarding:

- how the objectives will best be accomplished,
- how the variables indicating the objectives can be measured,
- what the relationship of each objective's value is to each other and to the success* of the project, and
- the role of the village in the decision making process.

This research paper presents a review of the site selection process, including a survey and comparative analysis of the site selection procedures currently in use. A recommendation of a site selection procedure concludes the paper.

Research methods

A literature review was conducted to :

- identify the problems and issues in site selection,
- identify the objectives of water supply investment,
- identify the controversies and problems regarding the objectives, and
- identify site selection procedures in use or suggested by donor agencies, governments, and non-governmental organizations.

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* Success is defined as the attainment and sustainment of the program objectives throughout the time period of the planning horizon.

In addition, a cross-sectional survey of recent project evaluations was conducted as a more rigorous examination of the problems that have arisen in the design and implementation of completed projects. The problems (and successes) identified through the survey could not be associated directly with the specific site selection procedures, due to lack of information within the reports of which procedure was used. However, the survey results did establish a common pool of issues to be considered in the formulation of any site selection process.

There are no evaluations in the literature of the actual performance of the various site selection procedures. The theoretical performance of the procedures was estimated through the examination of the relationship of the different selection procedures to the objectives of water supply improvement. Comparisons between the procedures were made regarding the measurement of the objectives, the assignment of relative value of the objectives, and the village's role in the decision making process.

In conclusion, a recommended site selection procedure is suggested, incorporated within a conceptual framework for a water supply improvement program. The recommended process was selected as the one most likely to satisfy the objectives listed previously in the paper.

Organization and summary of research

A summary of the review of problems and issues is in Appendix 1. The cross-sectional survey is in Appendix 2.

Chapter 1 presents the objectives common to rural water supply improvement programs and a discussion of the uncertainties within the site selection process regarding: the difficulty in attaining the objectives; the problems in measurement of the variables indicative of the objectives; the controversy of the relative importance of the objectives in relationship to each other and to the success of the project; and the question of whether the site selection procedure should provide information by or about the villages to a centralized decision authority or whether the villages themselves should have a role in the decision making process.

Chapter 2 is a survey and comparative analysis of the site selection procedures. Five processes are now in use for the selection of sites in rural water supply investment programs: cost analysis, political processes, preconditions, indices, and

benefit cost analysis. Cost analysis has the primary objective of minimizing costs, thereby serving the largest number of people for the lowest cost. Political processes rank the possible sites through the intuition or political objectives of the decision maker. Preconditions establish a minimum level of criteria that must be met by projects in order to be considered for investment. Villages eligible for investment are then ranked by time of application, geographical region, political preference, or other means. Indices characterize the social, technical and economic aspects of villages through the use of ordinal scales, the results of which can be combined together to yield a numerical ranking. Benefit-cost analysis compares the economic costs and benefits of the different projects, investing first in the projects yielding the greatest benefits, net of the costs. One or more of the processes can be applied within a single program. Examples of the application of the processes within specific programs is given.

An estimation of the validity of each process, i.e. how well it will produce results that meet the program objectives in Chapter 1, is given at the conclusion of each section.

The chapter concludes with a comparative analysis of the five processes in regards to measurement of the indicators, the relative value of different objectives, and the role of the

village in the decision making process.

Chapter 3 is a presentation of a conceptual model of the site selection process and a recommendation of a site selection procedure. Site selection is not a process occurring within a vacuum; it is affected by the procedural and ethical framework within which it operates. The objectives relating to the incorporation of community participation and to equitable access to the opportunities for investment in particular are influenced by decisions made throughout the site selection process.

A three dimensional model is suggested. One dimension consists of the planning and implementation cycle; the second dimension is comprised of the different aspects of water supply improvement, namely the technical, financial, economic, social, environmental, political and institutional facets; the third dimension is the ethical framework within which the entire decision system operates. A comprehensive approach to the site selection process, the model is an illustration of how the many diverse aspects of water supply improvement are interrelated.

Because the site selection processes now in practice fail to fully address the objectives in Chapter 1, an improved procedure - a combination of a preconditions process and a benefit-cost

analysis - is suggested. All objectives can be considered within the process. The risk of project failure is reduced through the clear identification of projects that do not meet the minimal criteria considered essential for success. It can be easily applied within an egalitarian ethical framework, chosen as the framework most likely to meet the objective of equitable distribution of water supply investment, and can easily accomodate an active community role in decision-making.

Once a pool of feasible projects has been determined through the application of preconditions, a modified benefit-cost analysis is performed. The benefit is measured as the time savings accruing from improved access. The costs are measured as the direct costs directly attributed to the project. Projects are stratified by socioeconomic status, within regional areas, in order to minimize the influence of income level in the comparison of net benefit.

The chapter concludes with a summary of the paper and with suggestions for further research.

Chapter 1

Objectives of the Site Selection Process

In many developing countries, improvements in village water supply are priority investments, and the programs initiated through the International Drinking Water Supply and Sanitation Decade have emphasized the development of rural supplies. However, a review of the literature regarding the rural water supply sector* coupled with a cross-sectional study of recent rural water supply improvement projects** generally indicates that few countries have programs that are replicable and/or sustainable, and that many of the services provided to date have been underutilized or abandoned.

The improvement of the site selection process is a response to this disappointing performance. Because the purpose of site selection is to identify those projects most likely to achieve and maintain the objectives determined from the water supply program goals, the improvement of the site selection process will strengthen the record of program success within the sector.

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* Appendix 1 is a literature review of the issues in rural water supply.

** Appendix 2 presents the results of a cross-sectional review of recent program evaluations.

Summary of the objectives

Depending upon the individual environmental and social circumstances, each country's program* will have specific requirements to be addressed in the objectives of water supply improvement. However a pattern of objectives common to most, if not all programs emerges from the literature. These objectives are to:

- Reduce human morbidity and mortality due to water related disease.
- Provide better access to reliable water supplies, thereby reducing the time and/or effort required to collect and transport water.
- Include the consideration of user-perceived preferences, particularly those of women - the main gatherers and users (in cooking, home and child care) of water - in the design of a project that the villagers want.
- Provide equitable opportunity for water supply improvement to villages of different socio-economic or political status.
- Minimize or eliminate the adverse environmental impacts that may accompany resource development and project operation.
- Incorporate community participation.
- Design and implement water projects that the villagers are willing and able to pay for (referring to payment of all of the operation and maintenance costs, and a portion of the construction costs).
- Operate and maintain the project throughout the time period of the planning horizon.

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* To define the terms, a program (national or regional level) consists of two or more projects (local level).

To meet these objectives, the projects that are chosen for investment must have technical, financial, economic, social, environmental, political, and institutional feasibility. The question of what constitutes "feasibility" in all of these areas is debatable, but project evaluations have suggested that there are criteria within each aspect that are related to project success. Briefly, these criteria are:

Technical feasibility: the technology used is at an appropriate level of service desired by and affordable to the population; supplies, parts and fuel are available for the operation and maintenance of the system; and trained, technical expertise is available locally.

Financial feasibility: the village is willing and able to pay at least a portion of the construction, and all of the usual operation and maintenance costs of the improvement.

Economic feasibility: the effect of the program on the country's balance of payments is minimized through the utilization of local labor, materials, supplies, and technology whenever possible.

Political feasibility: the projects do not conflict with local, regional or national goals.

Social feasibility: the village wants the project, is involved in

the planning and implementation, and retains all responsibility for the operation and maintenance.

Institutional feasibility: an institutional framework exists at the village level that is capable of project leadership, including the representation of the project at the program level; the formulation of policies and procedures relating to the project; the management of the operation and maintenance of the project; and the enforcement of penalties for non-performance, non-payment or other infractions of administrative policy.

Attainment of the objectives

It is a challenge to attain any of the objectives, but four objectives are particularly difficult: the reduction of water-related disease, the equitable distribution of investment, the minimization of environmental impact, and the sustained operation and maintenance of the programs.

The primary objective of water supply improvement in developing countries is the reduction of water-related disease. A significant body of evidence (McJunkin, 1982:87 ff) indicates that improvement of water supplies is positively linked with improvements in health status; however, a measurable impact at

the project level may not be evident, due to the complex nature of water-related disease.

This complexity is due to a variety of reasons. First, water is necessary for health, but good water quality alone is not sufficient for the realization of substantial health benefits (Carruthers, 1973:52). Water-related disease may be water-based, water-borne, or water-washed; therefore, both the quality and the quantity of water is important in the reduction of disease. Second, there are other factors that interact with the provision of a safe supply to maximize health benefits such as nutritional status, income levels, and educational levels. Third, human behavior, rather than the provision of an improved supply, may be the primary factor in the achievement of major health benefits. Benefits are dependent upon the use of the supply by users. Also, safe water provided at the source or tap may be contaminated in transport or at home through poor sanitary practices. Since water supply improvement programs in the past have been concerned primarily with the <u>provision</u> of a supply, and not with the incorporation of the various social factors involved in its use, the yield of health benefits has been disappointing.

The objective of equitable distribution of investment is

also difficult to achieve. Water is a basic need* for humans, and participation in a water supply improvement program should be based upon need, rather than income level or political power.

However, the costs and benefits of projects are affected by the income levels of the villages, thereby indirectly affecting the equitable opportunity for investment. For example, the attainment of health benefits and the probability of continued operation and maintenance of projects have been positively linked with income and education levels; therefore, poorer communities may be at a disadvantage in the competition for program funding. Also, poorer communities may have higher costs associated with their projects. Complementary investments are more likely to be necessary in low income communities, to compensate for inferior access to good roads and communication networks, as well as to supplement local materials and skills.

The objective of minimizing the environmental impact of water supply development involves the consideration of policies, laws and customs on the national, regional and local levels. Although a program objective rarely considered on any

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* The World Bank (1980a) emphasizes the four core needs of water, health, nutrition and education in their "basic needs" investment programs. The need for water is defined in terms of the percentage of population without access to safe water.

level other than the local one, environmental protection can only become more important as the competition for water and land increases.

Conflict may arise between the levels of government when the laws governing environmental protection are rudimentary or vague, and where the policies and customs differ from region to region (or tribe to tribe). Conflict may also occur due to different priorities among the governing bodies. For example, national priorities for the location of water supplies (and thereby the location of settlements) may conflict with local villagers' needs and desires. The absence of an effective institution or procedure for adjudication of conflict will result in either delay of the project or in the neglect of the consideration and mitigation of environmental impacts.

Regional impacts of water development are difficult to predict, because of the lack of information in developing countries regarding the capacity of water resources, particularly groundwater aquifers; the volume of water withdrawals; and prediction of human behavior regarding water use and patterns of settlement. A single project may have a negligible impact associated with it. However, taken together, the impact of the projects of a region may be significant.

The objective of sustaining the operation and maintenance of the project throughout the time period of the planning horizon has been particularly difficult to achieve. The site selection process addresses the attainment of this objective through assessment of the overall feasibility of the projects, as mentioned earlier. The main problem in the assessment of project feasibility is that prediction of human behavior is difficult, particularly in villages where a new technology or level of service is being introduced. In particular, assumptions regarding the motivation of each village and its feelings of project ownership have often been erroneous in the past.

Measurement of the objectives

Measurement of the variables that are indicative of the objectives is problematic. In villages that are the recipient of other infrastructure or development programs, the estimation of the impact of the water supply alone may be complicated. Additional difficulties that occur in measurement of indicators include:

- the possible lack or inaccuracy of data at the village level;
- the limitations in statistical comparisons between villages due to small sample size or infrequent events (such as death);
- the lack of established methodologies for the estimation of the objectives;
- the expense of traditional anthropological, social, and health impact assessment.

The measurement of health impacts has been particularly perplexing, due to the many factors (discussed earlier) that influence water-related disease. The rigorous assessment of health impact on the village level is impractical because of the difficulty, and associated expense, of controlling for the interactive variables of human behavior, water quality and multiple sources and routes of disease transmission.

Because the quantitative measurement of health impacts at the project level is impractical, Churchill (1987) has suggested that health benefits be examined only where the measurement of non-health related benefits, such as time savings, is ambiguous. Other authors [Feachem et al. (1978), Cairncross et al. (1980), Grover (1983)] assert that the measurement of health status is crucial, both for the estimation of need and as an evaluative tool for the intervention.

The health status indicators best suited to the assessment of water-related disease are anthropometry, infant mortality, rates of diarrheal disease, and the presence of dracunculiosis (Struba & Iseley, 1981). Excepting dracunculiosis (guinea worm), the validity of each indicator, i.e. its ability to reflect health status as affected by water supply, is inversely related to its practicality as a field applied measure. Dracunculiosis can be eliminated solely through the purification

of water at the source; therefore, in areas where the disease is endemic, a technological solution can eliminate the disease with very little change in human behavior required. The next most valid indicator, diarrheal disease, is difficult to assess in both extent and intensity. Mortality rates, of intermediate validity, are often not recorded, making comparisons between sites difficult, and may occur at a rate low enough in sparse populations to render statistical comparison meaningless. Anthropometry (in this case, the measurement of mid arm circumference) is an indicator of nutritional status in children under five years of age. It is an indirect measurement of diarrheal disease since excessive rates of diarrhea are one cause of malnutrition. It is the least valid indicator, but is easy and quick to measure, and requires little specialized equipment or expertise.

The choice of a health status indicator would depend in large part upon the availability of records and expertise at the village level.

Relative value of the objectives

The importance of the objectives relative to each other is the subject of much debate. At this time, an objective evaluation of the relative worth of the objectives in regard to their importance to the success and value of the project has not

been done. Three subjective methods to determine the relative value of the objectives can be found in the literature: political actors may decide the relative worth intuitively; "experts" may be polled, and the results aggregated, to value the objectives by majority rule; or the value may be assigned arbitrarily by the decision maker.

Role of the village in the site selection process

The question of who shall decide what sites are selected and how is controversial. Four major stakeholders are involved in each program:

- the donor agency
- the governmental officials
- technical experts, and
- the villagers, or users of the system.

Each of these groups has its own goals and objectives, some of which may directly conflict with those of the other groups. The examination and discussion of the complex interactions both within and between each of these groups is beyond the scope of this paper. However, a discussion of the village role in decision making is included because of the repeated implication of "lack of local interest or feelings of project ownership" as a reason for project failure.

The provision of a water supply that villagers want and will support financially and managerially is the goal of most programs, yet, paradoxically, effective mechanisms for incorporating the preferences and capabilities of villagers are often not incorporated into the site selection process. In practice, community participation has often been limited to the provision by the villages of materials, land, and labor.

The major site selection processes now in use are based upon central control of project planning and implementation.

Increasingly, it is suggested that the villagers themselves retain control of the process. In this "bottom up" decision framework, the national government would advise and assist local governments on request as the communities assess the local situation and formulate a plan accordingly. Villages would compete for funding at the national level on the merits of their projects.

In summary, there is general agreement upon the objectives of a rural water supply improvement program. The choice among projects involves the consideration of each project's overall feasibility as well as the comparison of the benefits and costs.

Controversy and/or uncertainty is present in four areas: the problems in attaining the objectives; the difficulties in measurement of the indicators representative of the objectives; the controversy regarding the assignation of relative value to objectives, some of which are potentially conflicting; and the role of the village in the decision making process.

A variety of site selection processes are in use, or have been proposed by governments, donor agencies and non-governmental agencies. The major approaches to site selection are surveyed in the following chapter in the five sections of cost analysis, political processes, preconditions, indices, and benefit-cost analysis.

There is no careful evaluation in the literature of how well the different site selection processes have performed in practice. To compare and evaluate the potential performance of the processes, the validity of each process (defined as the extent to which it addresses the objectives of water supply improvement) is discussed in the summary of each section. The chapter concludes with a comparison of the processes in regards to the issues of measurement, assignment of relative value to the objectives, and the decision making role of the village.

Chapter 2

Survey of Site Selection Procedures

Introduction

Five processes were identified in the literature for the selection of sites in rural water supply investment programs. Cost analysis generally has the primary objective of minimizing per capita costs, therefore serving the largest number of people for the lowest cost. Political processes rank the possible sites through the intuition and/or political objectives of the decision maker(s). Preconditions use a checklist, or series of checklists, to document the social, financial, economic, and technological conditions of a village. The assessment of preconditions allows the planner to identify high potential projects, illuminate constraints, and recognize the projects lacking essential components. Villages meeting the requirements specified in the checklists are all eligible for investment, and may be ranked by time of application, geographical location, political preference or other means. Indices, like preconditions, examine the various social, technical and economic aspects of development but, unlike preconditions, characterize the results of the analyses by numerical scales. The resulting "score" of the sub-indices can be combined to yield a definitive project ranking. Benefit-cost

analysis compares the economic benefits and costs of the different investment possibilities, giving priority to the project yielding the greatest net benefit (benefits minus costs).

A discussion of each of the processes follows, and examples (when available) are given to illustrate specific applications.

Cost analysis

Costs may vary widely among projects due to differences in the factors of terrain, population density, village size, choice of technology, level of service, local prices, and the availability of labor and materials. Cost minimization is most often one of several criterion used in site selection but, as one of the most easily quantified parameters, cost often assumes primary importance in the ranking scheme with more subjectively measured criteria following. As a site selection procedure, cost analysis may be used to rank sites by per capita cost or may be applied as a constraint in terms of a maximum permissible cost per head (Cairncross et al, 1980:37).

One approach to site selection on the basis of cost is to grant priority to projects with the lowest per capita cost. Because economies of large scale production will result in a lower per capita cost, this method favors the selection of larger

villages. (Reduction in per capita cost can also be attained in areas of smaller village size through the spatial clustering of projects in geographical regions.) In addition, this ranking procedure will also favor villages close to the administrative center of the program, located in areas of good access to transportation and communication. Projects in more remote villages tend to be more expensive for three reasons:(1) the increased requirements for time and fuel in transportation; (2) the increased difficulty in communication resulting in time delays and problems that increase project costs; (3) the possible need for complementary inputs (such as the construction of a road) to allow access to the site for materials and supplies. These increased costs will handicap remote villages in a final site selection ranking based primarily upon costs.

Unfortunately, a specific application of cost analysis used alone as a site selection procedure was not located in the literature. Because cost analysis is the primary component of the Pan American Health Organization index, the reader may wish to refer to the section on indices.

Summary of cost analysis

Cost analysis is often used in conjunction with other processes in the ranking of projects. As it is easily quantified, the cost of a project may assume primary importance

among the factors used for the ranking.

The validity of cost analysis used alone as a site selection procedure is low. The procedure does not directly address any of the objectives given in Chapter 1, with the partial exception of the provision of water supplies that people want and are willing to pay for. All other things equal, people prefer a less costly source of water than a more costly one; however, the minimization of per capita cost is not the only variable determining a desirable source. For example, people may be willing and able to pay more for a higher level of service or for the provision of more supply points, to result in a greater reduction in travel time.

Other objectives are addressed indirectly, through assumptions. For instance, it may be assumed that all benefits, such as better health or access, are equal in projects which are built to the same design standards. It is assumed that the likelihood of attaining the benefits is also equal among all of the projects; i.e., villages will respond similiarly to requirements about community participation or other social matters. As can be inferred from the literature (with the many denotations of problems with community participation and other social matters),these assumptions have not always held.

SUMMARY CAPSULE

for

COST ANALYSIS

Projects are ranked by: per capita cost or maximum permissible cost per head, with cost defined as the financial charges of land, labor, capital, and administration.

Assumptions:

- Yield of benefits assumed to be equal in all projects using the same design standards.
- Community assumed to prefer lowest cost project.
- The ability to operate and maintain the project is satisfactory in all projects, because the technology has been planned to be "appropriate".

Strengths of method:

The methodology is well established, and it is inexpensive.

Drawbacks of method:

- Method favors larger, more centrally located and prosperous communities.
- There is considerable uncertainty about the sustainability of the project, due to the negligible information regarding social preferences and capabilities.

Examples:

-Pan American Health Organization (see section on indices).

The reliance upon per capita cost as the primary site selection criterion may lead to inequitable opportunity for water supply improvement. The decreased access to roads and communication networks that handicaps the more remote villages

characterizes poorer villages, as well. Therefore, a cost analysis site selection process will tend to select sites in central, more prosperous areas.

Another criticism of the use of cost analysis as a method of site selection is that the full cost of the water is not considered. The prominent role of cost minimization in the selection of sites is one factor that has encouraged agencies and governments in the past to emphasize the construction of low capital cost projects such as communal handpumps and standpipes, that require users to carry water over (sometimes considerable) distances. These projects, inexpensive to build, may have high costs in operation when the value of peoples' time spent in the gathering of water is considered. This high "cost" of the water, as perceived by the consumer at the village level, has been implicated as a possible cause for the abandonment of some systems (Churchill, 1987:34).

Political processes

Often political considerations are the major determinants of site selection (Saunders and Warford, 1976). Political processes refer to the procedures of site selection that use political actors, with varying degrees of objectivity, to choose among sites.

Political processes may select sites by criteria that are not directly relevant to the objectives of water supply improvement. Choices among projects may be made upon basis of the political power of the villages involved or as a response to the most vociferous demands for service. Political processes may grant priority to sites that are the targets of existing socioeconomic programs, such as growth point strategies, income redistribution and 'worst first' strategies (defined in Appendix 1) in order to concentrate investment into politically determined areas. Projects may receive priority because of the presence of a school or other public institution in the area to be served by the project.

Political actors may also determine the relative value of the objectives of water supply investment to one another. Site selection is a complex process with many objectives, and as mentioned earlier, controversy exists over the value of each objective relative to the others. Prominent authors

(Carruthers, 1973:59; Feachem et al, 1978:240; Glennie, 1982; Lauria, 1988:3) have concluded that these decisions are political in nature, to be made on the basis of relevant technical, economic and social information.

An example of a political site selection process is given in a World Bank handbook on the planning and implementation of water supply programs (Grover, 1983:96 ff). It is suggested that the site selection process identify the projects with the most urgent needs, and/or the greatest ability to serve the largest number of people at the lowest cost, and/or the greatest capacity for self-help and maintenance are served first. These objectives are not mutually exclusive, and political actors are responsible for the weighting of each objective.

Aspects of "need" that may be considered are the seriousness of water-related disease, the distance or difficulty in access to the usual water source, the reliability of water, the existence of sanitation related disease, and the possibilities of additional productive enterprise currently hampered by lack of water. The assessment of capital and operating costs involves the consideration of the technical feasibility and whether or not the alternative is the least cost method of obtaining the required result. A community assessment of technical capacity, financial capacity, and socio-

administrative structure indicates the capacity and willingness of the community for self-help.

Once the data have been collected, the projects are evaluated by the political actors. Agreement is reached among the political actors on the relative importance of need versus cost versus community capacity for self-help, and the projects are ranked accordingly.

Summary of political processes

Political processes use the discretion of political actors in the selection and ranking of projects.

The validity of a political process is dependent upon which objectives are addressed, the precision and validity of the indicators used in the measurement of the chosen objectives, and the skill, insight and consistency of the political actors. Those processes oriented towards objectives not relevant to water supply improvement, such as political gain, are not likely to attain the objectives listed in Chapter 1. Processes that feature the role of political actors in the determination of relative value of objectives can be valid, if decisions are based upon objective information regarding the costs, benefits and feasibility of the potential projects.

SUMMARY CAPSULE
for
POLITICAL PROCESSES

Projects are ranked by: the choice of political actors, based upon varying bases of information.

Assumptions:

- Political actors are best equipped to decide the relative value of the objectives, particularly with the lack of another method.
- Political actors can estimate with an acceptable level of accuracy the indicators related to social factors (in the absence of other information).

Strengths of method:

- can be inexpensive.
- Centralized decision-making is practical.

Drawbacks:

- Political actors may not be consistent, or may lack the analytical skills.
- Projects may be ranked through the consideration of objectives not directly related to a water supply improvement program, such as political power.

The potential of a political process to meet the objective of equity is also variable; however, it is probable that it will favor the groups with greater political power.

Preconditions

Preconditions processes use a checklist, or series of checklists, to document the feasibility of a project. The use of preconditions allows the planner to identify high potential projects, illuminate the constraints of all projects, and recognize those projects lacking essential components. Four applications of the process are summarized in the following paragraphs: Warner (a policy analyst for U.S.A.I.D.), CARE, the New Transcentury Foundation, and the Overseas Development Administration.

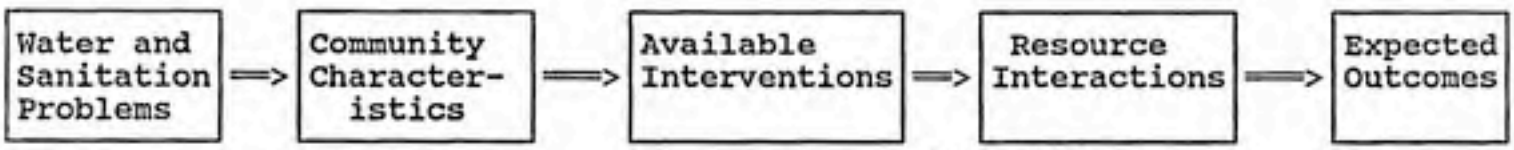
Warner (1981)

In a policy paper prepared for the U.S. Agency for International Development, Warner addressed program formulation and project identification using a framework of social and economic characteristics, or preconditions as he labelled them, that influence the outcome of development programs. Preconditions, as defined, include the existing conditions and constraints, as well as complementary investments necessary to

overcome the constraints. Warner's site selection process (not yet operational) would thoroughly assess potential sites, and then compare the assessments with a list of guidelines, established by the national government, reflective of the goals of the water supply program.

The hierarchical model suggested to identify potential sites for project investment is illustrated in Figure 2.1. The optimal time to identify and assess preconditions is the period immediately following problem identification. In theory, each step in the process would be reviewed in its proper sequence before proceeding onto the next step; Warner notes that, in actual practice, a planner will probably simultaneously consider all categories, moving among them as needed.

Figure 2.1
Warner's Hierarchical Model



The five general categories of preconditions correspond to the five boxes in Figure 2.1. Briefly outlined below, they are considered in greater detail in the following paragraphs (Warner, 1981:120):

1. Problem identification - the water supply problems and corresponding community needs that can be addressed within the context of relevant national, community and USAID goals and objectives.

2. Socioeconomic status - the social and economic attributes of people within project communities.

3. Level of technology - the hierarchies of technological choices which are suitable in the project communities.

4. Support conditions - the types of existing conditions, complementary investments, and project-induced conditions that are necessary to support the selected intervention.

5. Benefit potential - the anticipated outcomes of a project in terms of immediate benefits, long-term benefits, and changes in support conditions.

The initial step in the site selection process is the

identification and assessment of needs, and the verification that there exists a desire for change. Needs refer to the problems of water quality, quantity, reliability, and/or access, and the perceived needs of the national government, USAID and the local community are considered. The degree of the desirability for change is considered within each decision-making unit, with the views of the community carrying the greatest weight.

An assessment of the socioeconomic status of the communities is conducted for two reasons. First, the evaluation of the needs of a community must be performed within the context of its social and economic status, since what is a shortage of water to one community may be considered a surplus to another. Second, indicators of socioeconomic status reflect the capacity of a community to benefit from an improved water supply.

Warner suggests the two best indicators of social and economic attributes are the poverty performance indicators already in use by USAID and the Physical Quality of Life index (Morris, 1979)*.

One difficulty with the use of these indicators is that

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* This is a composite index giving equal weight to the factors of literacy, life expectancy at age one, and infant mortality.

the information generally exists at the country level only, although occasionally data from previous studies or project reports are available at the community level. In the absence of complete existing data, certain components of the indicators can be estimated crudely in the field through informal sampling, interviews, and observations. These include percent of population under age 15, calorie intakes, school enrollment ratios, adult literacy rates, and employment ratios. Warner suggests that a social wealth index, that could be quickly assembled in the field, could also be used to indicate socioeconomic status. Components of the index would include the value of housing, personal property, farm equipment, and personal transport.

Another component of socioeconomic status is the condition of existing water and sanitation facilities. Measurement of quantity, quality, accessibility and reliability are the key indicators here, and can be measured on ordinal scales (i.e. gallons per day) or on nominal scales (i.e. available or not available in dry season).

Therefore, the measurement of socioeconomic status in a community would be reflected as a composite of the poverty performance indicators, the Physical Quality of Life index, a social wealth index, and an indicator of the existing condition

of the current facilities.

The results of the assessment of needs and the socioeconomic survey are used to propose a technology for each potential site. The appropriate level of technology is defined by the characteristics of the community and involves decisions regarding the service level, design sophistication, costs, and maintenance requirements.

The assessment of support conditions follows the choice of technology. Defined as the technical, institutional, administrative and infrastructural factors needed to nourish and sustain a program or project, support conditions are classified into three groups - existing conditions, additional or complementary conditions, and induced conditions. The existing conditions consist of the available human, institutional, and material resources essential for project support. Additional inputs and complementary investments necessary to generate specific support conditions may include a health education program or the construction of an access road. Anticipated short term changes in support conditions likely to result from project development complementary investments are the induced conditions. The example given by Warner of an induced condition is that of an initial constraint of lack of skilled labor being rectified by a complementary input of a labor training program,

which eventually alleviates the skilled labor constraint. At this stage in the site selection process, the planner anticipates the support conditions that will be necessary to construct and manage the proposed project.

The final stage in the assessment of potential sites is the estimation of benefits expected to accrue from the project. Benefits are summarized in two categories: the immediate behavioral and institutional changes associated with the project, and the long-term changes in support conditions that increase the stock of available resources for the future.

The benefits of the project are the anticipated health, social well-being, economic and environmental quality changes that occur. Warner distinguishes between the technical inputs into a project (changes in the quality, quantity, accessibility and reliability of water), which are measures of system operation, and the measures of system performance, as reflected by short-term behavioral and institutional changes. Changes in the inputs are not an accurate measure of benefit for only through increased use, improved hygiene, and growth of community support for the system can benefits be realized.

Long term benefits also may occur. Examples include an increase in trained labor, growth of experienced community

institutions, and an acceptance of community participation as a means of obtaining community goals.

Warner notes that while it is not always feasible to exhaustively characterize the preconditions, it is necessary to at least choose two or three key preconditions in each category to assess.

As the cumulative step in site selection, the site assessments are compared with guidelines established by the national government. The guidelines are intended to be as quantitative and specific as possible, and to address goals within each category of preconditions (needs, socioeconomic status, level of technology, support conditions and benefit potential). Projects meeting all of the guidelines are selected for implementation.

CARE

Water supply and sanitation activities account for 20% of CARE's non-emergency, non-food assistance program. In 1982, CARE spent $11 million on 39 projects in water supply, sanitation and irrigation in 20 countries. CARE usually operates within communities that are relatively impoverished and are generally lacking in sophisticated management skills.

The water supply programs are notable for the strong emphasis on community participation. Communities are expected to contribute a portion of the labor and materials for the construction phase of the project, and will operate the system, collect and administer funds for recurrent costs, and perform routine maintenance tasks themselves. Reliance on resources available within the community is emphasized, including the political and administrative resources necessary to manage a water system and resolve conflicts. In some areas, CARE's self-help approach has been rejected by local villages in favor of other agencies' assistance requiring little or no community input of materials and labor (Tomaro, 1985:9).

CARE uses a preconditions approach to the site selection process. Potential projects are identified, assessed in terms of the specified criteria*, or preconditions, and selected or rejected for implementation. Figure 2.2 is an outline of the site selection process; a brief summary of the major procedural steps is given below.

The first step in program development is the collection of regional and national background material. This material

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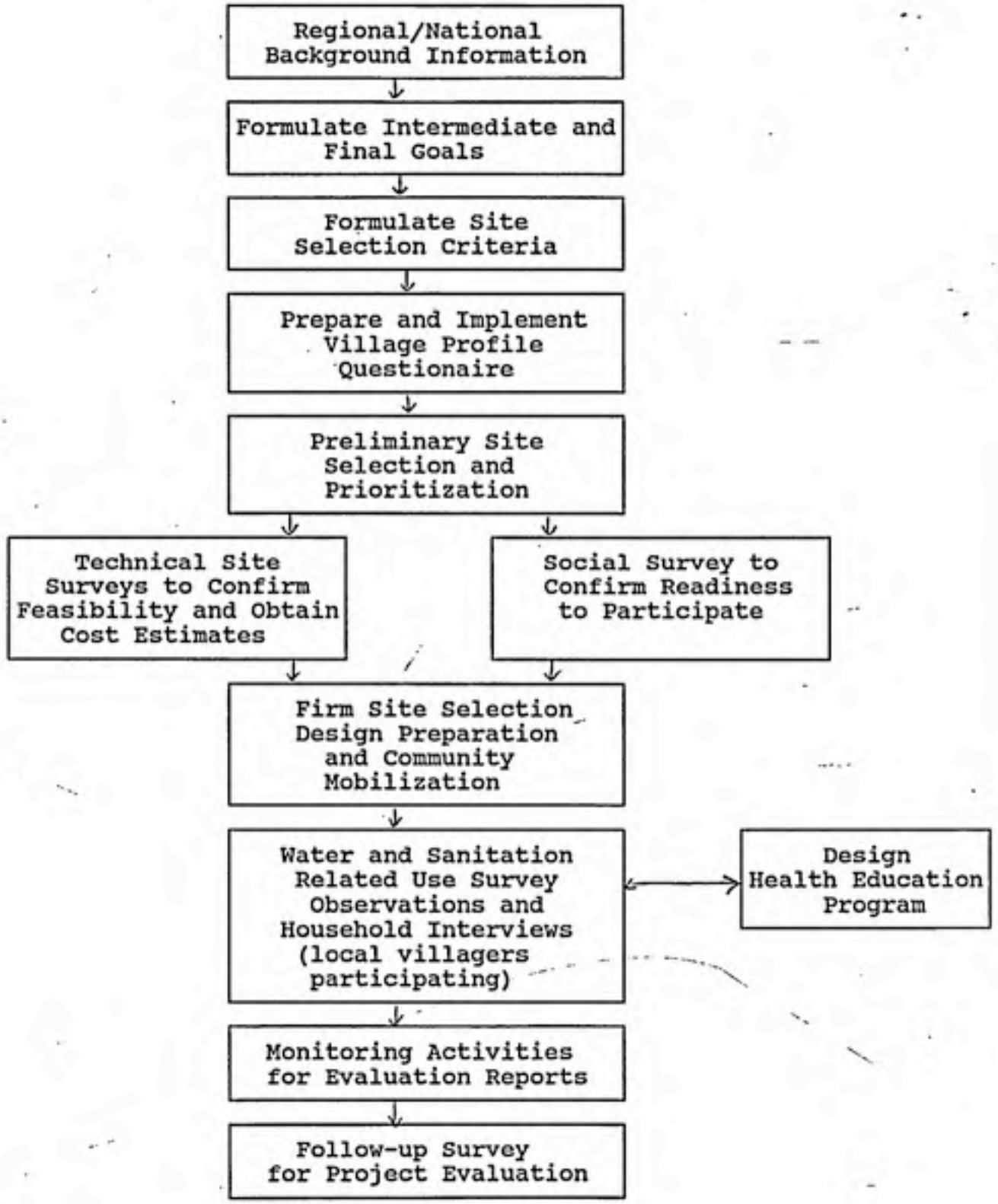
CARE uses the term "criteria" to describe constraints and decision rules. I have followed this convention in the CARE section.

Figure 2.2
CARE's Site Planning and Selection Process
(adapted from Isely et al; 1986)



includes health statistics on life expectancy, infant mortality, and the incidence of specific water related diseases as well as statistics regarding per capita income. This material is used to formulate the objectives and goals of the program.

The site selection criteria are formulated to identify the projects that will attain the water supply program goals. The criteria are two tiered: the first tier, the primary and technical criteria, specify targets that projects must reach in order to be eligible for inclusion in the program; the second tier, secondary criteria, specify targets not essential to project success but fulfillment of which will be considered in the priority ranking of projects. To illustrate the criteria used within the CARE program, the following list is given (excerpted from criteria of a hypothetical program; Iseley et al, 1986:129).

Primary Criteria

1. The community must be under the authority of the provincial governor.
2. The present source of drinking water must be at least 500 meters from the center of the community.
3. The community must form a water committee and collect an initial capital fund of $250 for a gravity system or $50 for each planned handpump.
4. A spring fed gravity flow system or handpump must be feasible.

Technical Criteria

1. Community users agree with the proposed location of the handpump.
2. There is sufficient indication that drilling/digging will yield a sufficient supply.
3. The site must be at least 30 meters from any sanitary disposal facility (septic tank, pit latrine, or drain that receives human waste).
4. A satisfactory drain can be constructed to carry away wastewater or construction of a seepage pit is possible.
5. There is sufficient land area to install an apron three meters square.
6. All local residents will have access to and free use of the pump.
7. The handpump will serve the needs of at least 50 people or 10 households.
8. The community accepts responsibility for pump maintenance and repair, and two persons attend (sic) the project training course.
9. A written statement is obtained from the landowner ceding the land for use as a public water source.

Secondary Criteria

1. Health records or field observations indicate that more than 25 percent of medical problems are water-associated diseases.
2. An outbreak of waterborne disease has occurred within the past two years.
3. There are no protected water sources in the community.
4. The community agrees to supply all unskilled labor.
5. The per capita cost of the water supply is less than $35.

After the site selection criteria are specified, CARE notifies communities throughout the project area of the

availability of the project. If interested, communities are asked to submit letters of request to participate in the program to the national or regional ministry or to CARE officials directly, as the situation dictates. Requests are generally considered on a first come, first served basis, although geographical clustering for logistical ease of operation or project promotion for better coordination with governmental or other developmental programs may occur (Yacoob, 1987 and Roark, 1987).

The village profile is a preliminary screening for the major factors influencing project success. CARE prepares the survey, with the assistance of the community, through site visits and questionaires. The profile assesses: basic village data concerning population, the location of roads and the presence of communication networks; the social structure of the community; water uses and practices; financial data; village health status; and the availability of institutional and technical resources for project operation and maintenance. comparison of the village profile with the site selection criteria identifies the projects with acceptable potential for success (as determined by CARE officials through an unspecified process).

Villages accepted in the preliminary site selection are

assessed in greater detail as to their technical and social feasibility. If the project satisfies all of the technical and primary criteria, a project plan is prepared. If needed to confirm the feasibility of the plan, further surveys and household interviews can be conducted. All projects meeting the primary criteria are eligible for implementation; however, projects satisfying the secondary criteria are given priority.

In summary, CARE uses a site selection process based upon targets, or criteria, that all projects must meet in order to be eligible for inclusion in the program. In addition, secondary criteria may be proposed, with the projects satisfying more of the secondary criteria receiving a higher priority in the final ranking of sites. Depending upon project conditions, the required criteria will vary but CARE concludes that the following list of minimum criteria is necessary to ensure project sustainability:

- an appropriate design,
- a local maintenance organization,
- a regional or national support system,
- an educated local population,
- trained system installers and maintenance staff,

- adequate transportation for technicians, materials and spare parts,
- long-term financing for operation, maintenance and spare parts,
- a source of supply for spare parts,
- an output which is perceived as vitally important by local users, and
- a sense of responsibility among the users for keeping the system in working order.

New TransCentury Foundation

One project of the New TransCentury Foundation (NTF) is a village rural water supply project in the Yemen Arab Republic. The project constructs tanks, distribution lines, and public and private taps, and trains local villagers to operate and maintain the systems.

A recent evaluation conducted by Laredo et al (1986) concluded the project was successful, with 172 of the proposed projects finished, a cadre of trained villagers maintaining the systems, and the remaining contractual obligations expected to be finished 2" years ahead of schedule. An evaluation of benefits from the program was not conducted as a quantitative analysis, but were elucidated in a general discussion. The most important benefit was noted to be the time savings for women. Villagers were reportedly using more water for washing clothes and household utensils and, in villages where meters were installed,

quantities withdrawn were slightly higher than before the project. All completed systems were in good operating condition. The evaluation calls the program "one of the most prominent USAID interventions in Yemen" (ibid:57).

The village site selection process is streamlined, and is based both upon political and preconditions processes. Initial selection is made through the Rural Water Supply Division (RWSD) of the Ministry for Public Works (MPW) by an unspecified process. The NTF evaluates the proposed projects, implementing only those projects which fully satisfy five points. The constraints are:

1. The population to be served at project start-up must be between 250 and 2000 persons.

2. The source of water must be adequate in terms of quantity and quality. Adequate quantity is defined as that amount necessary to satisfy the maximum daily demand for year 10 of project, assuming a 2% population growth annually. Adequate quality is defined as "meeting standard bacterial and chemical levels" (ibid:34).

3. Site access must be reasonable, with the project located no more than one-half hours' distance from the access road.

4. The estimated development cost, not including the source, should not exceed YR900 per capita (YR8.99 = US$1) and the entire cost should not exceed YR900,000.

5. The villages must agree to contribute at least 30% of the project's capital cost, and to accept responsibility for the operation and maintenance of the system (including all financing and labor).

The subprogram survey is conducted by NTF after being assigned a project from the RWSD. The responsible village leader (usually the shaykh, or village headman) is informed of the RWSD assignment of the project to NTF, and a date is set for the survey. The shaykh and the NTF engineer(s) cooperate in the initial layout of pipeline routes, and a preliminary cost estimate is calculated. If all five constraints can be satisfied, an agreement is drawn up and construction is scheduled. Two people from the village are trained as caretakers, to be responsible for the daily operation and maintenance of the system. There is no health education component.

Overseas Development Administration

The appraisal method of the Overseas Development

Administration (ODA) is similar to the preconditions processes noted above in that its primary purpose is not to rank projects in order of priority based upon expected benefits or costs, but to eliminate those projects with a low potential for success. It is suggested that point or weight ranking methods may be applied in order to keep the site selection on a consistent basis, avoiding personal prejudice, but the objective basis of such methods is limited, and the best that can be hoped is that "the most outrageous proposals can be excluded and those villages most glaringly in need included" (1985:39).

Although specific criteria for selection (or rejection) are not given, the ODA's appraisal process uses a series of assessments and ultimately compares alternatives on their strength of performance within each assessment.

- The assessment of existing supplies examines the quality, quantity, reliability and accessibility of the current situation.

- The assessment of need is indicated by the relative incidence of water-related disease and the amount of time and effort required to collect water. The variation, and possible unreliability, of health statistics coupled with the methodological difficulties in the assessment of health

benefits has lead the ODA to conclude that health statistics are a crude estimate of need for water supplies. More reliable as indicators are measurements of the time and effort required to gather water. Round trip travel time is suggested as an easily measured proxy indicator of the time and effort that will include such factors as accessibility, queuing time, terrain, and the height of which the water must be raised.

- The assessment of the likelihood that the schemes will be maintained is important. The extent of community interest, and the availability of spare parts, supplies, and the trained labor necessary to maintain the systems are factors.

- The assessment of complementary factors, in particular the presence of health education and sanitation, is undertaken although the absence of these measures can be compensated for within the project itself through appropriate compensatory investments.

The ODA suggests that consideration of the capital and recurrent costs cannot be ignored in the site selection process; however, costs will provide an unequivocal ranking only when the costs of two alternatives are the same while the estimated

benefits differ or when the benefits are equal and the costs differ. It is stated that "in all other cases (which account for the majority) no solution is provided by this method" (1985:41).

Time savings is suggested by the ODA as providing the most useful guide to project selection. In addition, presumably if the benefits are estimated to be similar among alternatives, a rough 'rule of thumb' is given to facilitate project selection. It is suggested that priority be given to: larger villages; those with access to an all weather road; those with schools and clinics; and those which have already contributed in cash and kind. It is considered more important to exclude projects which have a low probability of success than to spend valuable time and resources refining a priority scheme for the ranking of reasonable schemes.

Summary of preconditions processes

Preconditions refer to the processes that use checklists, or criteria, to specify minimum levels of requirements that the projects must meet for inclusion in the water supply improvement program. The likelihood of project failure is further reduced through the extensive evaluation of the village's preferences, capabilities, and environmental setting.

Preconditions processes address the objectives of water

supply improvement through the specification of criteria. For example, criteria can be formulated to direct investment towards villages with certain rates of water-related disease or a minimum level of time savings expected to accrue from a project. Since the criteria address each objective separately, decisions are not necessary regarding the relative importance of the objectives in respect to each other.

Standardization within a program results from the use of extensive criteria. A benefit of standardization is that it requires less quantification, therefore time, money, and expertise, on the part of the decision makers. Conversely, standardization hampers creative solutions to individual problems and may result in a project less adapted to the specific site conditions.

The objective of equitable access to the water supply program is addressed in a preconditions process through the use of complementary inputs. These inputs, available to the villages who require assistance in meeting the criteria, do not penalize the village in the final ranking process.

SUMMARY CAPSULE
for
PRECONDITIONS

Projects are ranked by: the use of guidelines, or checklists. A pool of feasible projects is formed, all of which are eligible for implementation. Dependent upon the program, projects are ranked by time of application, geographical region, or political preference.

Assumptions:

- The use of standards is the best way to reduce the uncertainty regarding the sustainability of project objectives.
- Conditions are relatively uniform throughout the area, (complementary inputs are otherwise available to rectify the differences).
- Projects planned to satisfy the constraints formulated by the central authorities also adequately address the preferences of the villagers.

Strengths of the method:

- Identifies projects meeting the minimum standards.
- Extensive information requirements lessen the possibility of unforeseen demands or expectations.
- It is an equitable process.
- Process is clearly understandable by all groups of decision-makers. Villagers whose project was not chosen can easily identify the deficiency.

Drawbacks:

- Expensive.
- Standardization of project plans may not reflect the the preferences and capabilities of local villages.

Indices

Indices, referring to various mathematical decision models, are another category of site selection processes. In an index, the indicators of different objectives are quantified and then aggregated together to result in a single number for each project. A final ranking can be made by listing the projects in a numerical order. Indices differ in the objectives that are addressed, the indicators that are chosen as representative of the objectives, the techniques of measurement of the indicators, and the relative value of each objective. Summarized below are four indices suggested by one organization, the Pan American Health Organization, and three (separate) authors: Harlaut, Soetiman, and Gunn.

Pan American Health Organization (Saunders & Warford, 1976:106)

Generally consistent with a strategy of maximizing the number of villages served is the formula developed by the Pan American Health Organization (PAHO) for selecting the villages or region in a country that will be first in line for water development.

The formula, used experimentally in the 1970's by the Inter-American Development Bank (IDB), is:

$$I = 100 * (P / (C-A)) * r * k$$

where I = an index of project selection priority in which a higher I indicates a higher priority

(P / (C-A)) = the inverse of the cost per capita of the system, exclusive of the costs of the distribution network and the village contribution (P = expected village population in 20 years; C = total cost, minus household connections, if any; A = counterpart contribution supplied by the government)

r = index of physical availability of water, defined as a ratio between the existing water flow at the point of capture and the forecast requirement of water for the village (20 year period)

k = index of household concentration in area, defined as the proportion of households located within 50 meters of the main conduit to total number of households in village or region

This index (I) will assign a higher priority to villages that require a lower per capita investment, are densely populated and have abundant water to meet projected needs. This result is consistent with a strategy to maximize the number of villages served.

In addition to utilization of the formula, IDB suggests that attention be given to (a) the distance to the water source; (b) the degree of unemployment in a community; (c) the type of service and the proportion of households to be connected;

(d) land tenure; (e) existence of other infrastructure facilities; and (f) operation and maintenance costs.

Harlaut Project Selection Method (Harlaut, 1975)

Developed in 1975-77 in Ethiopia and Botswana, Harlaut's method is based upon position analysis. In order to reduce subjective judgement, factors of human and social nature are not evaluated. The method allows for the comparison of judgements of various groups (users, authorities, and operators) and for giving different priorities to the judgements of each group.

The first step, data collection, describes the following subjects: topography, general information on health, water sources, existing water supply, operation and maintenance, water consumers, ownership, financing, implementation, and social aspects, such as the availability and skills of personnel.

The second step, data processing, evaluates water quality and health hazards, capacity of the source, capacity of the installations, functioning of the distribution system, technology in use, mistakes in design, operation and maintenance routines, personnel resources, capital resources, operation and maintenance costs, price acceptability, distance or convenience, reliability, participation, and environmental criteria.

Groups of interest are identified (such as consumers, owners, operators, authorities), and requirements of each group are examined. On some items, all groups may have similar requirements - such as on reliability. On other items, the groups may differ. Comparison of the similarities and differences leads to the construction of a series of matrices. Comparison of the matrices leads to the final decision.

Soetiman Priority Model (Soetiman, 1977)

The Soetiman Priority Model was developed in Indonesia. The formula used is:

$$PI = \sum_{i=1}^{10} (W_i \times S_i)$$

where: PI = Priority Index for a certain village
W = Weight of each parameter
S = Score of each parameter
i = Subscript denoting the parameter i

The ten parameters are:

1) Waterborne diseases;
2) Difficulty in obtaining water;
3) Technological alternatives;
4) Population;
5) Village contributions;
6) Village potential;
7) Public places;
8) Excreta disposal;
9) Road conditions;
10) Power supply.

The weight (W) of each parameter was determined in a Delphi panel

of 28 experts from different countries. The score (S) of each parameter was assumed with village questionaires. Unfortunately, the description of the model did not include the actual weights and scores that were determined in the process.

Gunn Priority Model (Gunn, 1982)

The Gunn Priority Model assigns a score (0 to 4) to eight descriptive parameters. The community's suitability for an improved supply is expressed as the sum of the scores from all of the parameters (best score is 32). The parameters are:

1) Community/area health status: qualitative observation, mortality of infants and children under five, water and sanitation related disease;
2) Community health programs: operational and planned;
3) Community development programs: housing, industry, education, etc.;
4) Community health worker or public health inspector;
5) Community's perception of need and its cooperation;
6) Manpower resources for construction, operation and maintenance;
7) Appropriateness of technology;
8) Financial resources for maintenance, monitoring and evaluation.

Summary of indices

Indices address the objectives of water supply improvement through the quantification and aggregation of indicators. A final ranking can be constructed through a numerical or matrix comparison of all projects.

Indices can be constructed to address all of the objectives in Chapter 1.

Indices require a greater level of quantification of the indicators, as compared to the processes discussed earlier. This quantification may be controversial for two reasons:

- A methodology for accurate quantification may not exist or may be impractical due to its expense, such as in the quantification of community participation.

- The scales of quantification for each objective may not be comparable, reducing the validity of the final rank.

SUMMARY CAPSULE
for
INDICES

Projects are ranked by: numerical or matrix representations of various subindices. Indices differ in the objectives that are addressed, the indicators that are used to represent the objectives, the relative value of the objectives, and the methods of measurement.

Assumptions: vary according to the index.

Strengths of the method:

- It is a format in which projects can compete on their own merits for program funds, and fosters plans suited to local conditions and capacities.
- The relative worth of the indicators is clarified through the assignment of a numerical value.
- The choice and the measurement method for each indicator is clearly delineated.
- It yields consistent rankings, based upon the indicators chosen.

Drawbacks:

- The assignment of relative value to the indicators is controversial, due to the different preferences and goals of the four stakeholders: donors, government, technical experts, and users.
- The quantification of the social indicators is controversial, and may not be based upon sound social assessment methods.
- The eclipsing effect may obscure the lack of a crucial component within a project.

The "eclipsing effect" of indices is of special concern. It is possible that a project will score well in the final aggregation of all indicators even though it has a low value in one or more indicators. Therefore, this effect may obscure the presence of a crucial lack within a project, increasing the probability of project failure.

The relative value of objectives may be determined in a variety of ways in different indices. For example, an arbitrary value may be assigned (as in Gunn's index); an expert panel can be consulted (as in Soetimann's example); or a political poll can be conducted (as in Harlaut's example).

Benefit-cost analysis

Benefit-cost analysis has increasingly been suggested as the process of choice in the assessment of potential water investment sites. The process is based upon the rigorous comparison of benefits with costs, and selects projects through the comparison of benefits, net of the costs.

Three examples of benefit-cost analysis are summarized here: Carruthers, Saunders and Warford, and the Inter-American Development Bank.

Carruthers

A pioneer in refuting the (at the time) widely accepted concepts regarding the realization of health and economic benefits, Carruthers (1973), basing the thesis upon empirical data, stated "an improved water supply, while necessary for improved health, welfare and economic progress, is not sufficient to ensure any desirable change within the community" (ibid:58). To ensure success, water supply investment must be coupled with complementary investments such as hygiene education or economic development projects.

In selecting projects, Carruthers suggests consideration of the benefits and costs of the project in a non-rigorous format. Benefits to be considered are improvements in reliability, quality and/or a reduction in distance to the source. If complementary investments are also made, benefits from the proposed project will be greater, and should be entered into consideration. Costs refers to the investment per capita, and may be lowered through community contributions of labor, materials, and/or funds. Carruthers concludes that there can be no objective way of choosing between a low cost project and an alternative project yielding high benefits. He recommends that sets of guidelines and criteria be issued to district decision makers, and thus they can come to an essentially political

decision on the basis of relevant technical and economic backing (ibid:60).

Saunders and Warford (1976)

In the classic *Village Water Supply* (1976), Saunders and Warford state that the determination of investment priorities is best based upon a ranking of project costs and benefits. The authors note that the estimation of costs is relatively straightforward, but the estimation of benefits is complex due to difficulties in three areas: the prediction of what measurable benefits will accrue; the measurement of the benefits that do accrue; and the placement of a monetary value upon the benefits.

Value judgements are necessary in order to address the program objectives that are not adequately measured in a benefit-cost framework. For example, a value judgement is necessary to decide whether or not it is desirable to invest in a project with a low, or negative net benefit but with a high incidence of water-related disease. Due to the difficulties in the estimation of the benefits and to the necessary value judgements, the authors conclude that the ranking of projects is ultimately dependent upon the judgement of the decision maker(s) and suggest that the factors of per capita costs, community enthusiasm, development potential, and the quality of the existing supply be seen as a complementary checklist by which

each project is judged (ibid:111). Through the systematic use of this checklist, the subjective weightings of the decision maker(s) can be made explicit.

Inter-American Development Bank

The Inter-American Development Bank (IDB) is using a benefit-cost framework in water supply and sanitation programs in Haiti, El Salvador, Honduras, and Chile. User contributions are required for eligibility for the program, and community participation is emphasized.

The major benefit from improving a supply is considered to be the resulting time savings. It is argued that other benefits, such as improved quality (as perceived by the users), reliability and access are indirectly measured by the surrogate of time savings since the choice of a source will involve the consideration of all of these attributes by a consumer. Since health benefits are difficult to quantify, it is suggested that they only be analyzed if and when needed to solve ambiguities.

Cost estimation includes the following variables: capital and labor costs, cost of development of the source, size of the village, and the density of the population.

Standard cost-benefit procedures are utilized to compare benefits with costs. Final site selection is made on the basis of a ranking of net benefit, with the projects yielding the greatest net benefits receiving priority.

Summary of benefit-cost analysis

Benefit-cost analysis selects sites through the comparison of benefits, net of the cost. The major benefit of water supply improvement is suggested to be the resulting time savings. The costs of the project are relative to the costs of labor, capital, and administration.

Benefit-cost analysis addresses most of the objectives, with the exception of equitable opportunity for investment. For several reasons, this process favors the selection of sites in areas of higher income:

- Project success is associated with greater levels of income; although the primary benefit of time savings might be of greater value in poorer communities, the increased uncertainty of project success will reduce the final value of the benefit.

- The costs of a project in a poorer community are

likely to be higher. Poorer communities are likely to have a decreased availability of supplies and skilled labor; an increased cost of materials; greater costs associated with complementary inputs necessary for project construction and implementation; and greater difficulties of transportation and communication.

Of all the site selection processes, benefit-cost analysis seeks the highest level of quantification. All indicators are quantified in the same units, usually a monetary one such as dollars, which can be directly added together for a single rank of benefit, net of the costs.

The quantification of some indicators is controversial. It may be difficult to assign a monetary value to some indicators, particularly the ones describing human behaviour, for example, community participation. The measurement of other indicators may not be politically feasible; an example may be the valuation of a human life, used in the quantification of the value of mortality due to water-related disease.

SUMMARY CAPSULE
for
BENEFIT-COST ANALYSIS

Projects are ranked by: benefits, net of the costs. The method may be performed on a formal or informal basis. The examples given here are all on an informal basis.

Assumptions:

- Benefits and costs in two of the examples given assumed the major benefit to be time savings, and the major costs to be the costs of labor, capital, and administration.

- Projects are assumed to yield health benefits, either directly or indirectly, and some analyses do not attempt to measure it.

- The direct comparatory unit is usually monetary.

- The value of social factors can also be measured as a additional incremental change in the probability of project success.

Strengths of the method:

-Directly assesses village preferences.

- Provides a format to foster the incorporation of village desires and capabilities into the project plan.

Drawbacks:

- Assigning a monetary unit to indicators not usually measured thus is controversial. It may not be understood or accepted by the villagers and governmental officials. Because of this, the analysis may focus on the indicators that are normally valued as money.

- Inequitable.

- It is relatively expensive, particularly where village surveys are used.

- The estimation of the incremental increase in project success associated with the inclusion of community participation or the capability of institutions is at this time, an educated guess.

Summary and comparison of procedures

A number of methods are in use, or have been proposed for site selection. Prominent among these are cost analysis, political strategies, benefit cost analysis, precondition checklists, and mathematical indices. Comparisons can be made between the procedures regarding how well the objectives are addressed*, how the indicators are measured, what the relative value of the objectives is, and what role the village has in the decision making process.

Measurement of indicators

The procedures can be compared as to the level of quantification employed to measure the indicators, and to the level of certainty, or precision, of the measurements.

A general progression in the level of quantification is evident among the procedures. Cost analysis and political processes are the least quantitative of the procedures, in that many of the objectives are not measured at all, or are assessed intuitively by the decision maker(s). Preconditions require the quantification of indicators on a nominal scale, as each

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* The validity of each procedure, i.e. how well the objectives are addressed, was discussed at the end of each procedure's section.

indicator must either meet or not meet the criteria. Some indicators may be quantified on an ordinal scale; for example, the incidence of water-related disease or the amount of time saved in the gathering of water by the project. Indices measure all indicators on ordinal scales. Although the scales for each indicator are aggregated together to yield a final number describing the project, some indices do not attempt to weight the scales to reflect the differences among measurement of the various objectives. For instance, all indicators in Gunn's model (1982) are measured on the same scale of one to four; however, a three rating for the indicator of health status is not directly comparable to a three rating in the indicator of available financial resources. Benefit-cost analysis requires the highest level of quantification of the indicators. All indicators are quantified on an ordinal scale, in directly comparable units (usually a monetary value). As discussed earlier, the quantification of some variables, not usually measured on a monetary scale, may be controversial.

Regarding the indicators that measure human behaviour, an increased level of quantification may be accompanied by an increased level of uncertainty. At this time, there is no rigorous, tested method to consistently measure the quality of community participation or the potential capability of institutions. Therefore, it is not known how much certainty is

gained or lost through the quantification.

Relative value of the objectives

The relative value of the objectives can be compared among the procedures. Political processes use political actors to evaluate the relative value of objectives. The assigned value will vary from actor to actor, and over time, as political goals change. Preconditions do not require the comparison of objectives, as all sites meeting the criteria of each objective are eligible for selection. Indices use a variety of ways to determine the relative value of objectives: political actors may decide; a group of "experts" may be polled; or an arbitrary value may be assigned. Benefit-cost analysis measures the indicators of some objectives in the same unit (monetary value), and direct comparisons among these indicators can easily be made. The indicators that are easily compared directly are the health status indicators, time savings in the collection of water,and the benefits and costs of the mitigation of environmental impacts. Other objectives, while incorporated into benefit-cost analysis, cannot be easily compared because they are not directly measured (such as the objective of incorporating the preferences of villagers into project planning). Finally, the objective of equitable access to opportunity for investment is not measured at all, therefore it has no relative value.

Role of the village

All of the procedures, as applied in the examples given, use a centralized approach to decision making. The village provides information to the central decision unit, and may assist the technical experts who assess the village potential and formulate the project plan. As the beneficiary of the project, the village is usually responsible for the operation and maintenance of the project, once constructed. The central decision unit may be a unit of government or an organization, and is assisted by technical experts. It is responsible for the identification of projects*, the assessment of data describing the villages, the development of a project plan (sometimes in conjunction with the villagers), and the comparison of the plans either to a list of criteria or to each other, in order to select sites for project construction.

In summary, the five major approaches to site selection - cost analysis, political processes, preconditions, indices, and benefit-cost analysis - differ in the objectives that are considered, the measurement of the indicators, the relative value of the objectives, and the role of the village in the

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* One partial exception to the role of the central unit as described above, is the requirement of CARE's that villages must identify themselves through a letter of application to the central unit.

decision making process.

The next chapter will present a conceptual model of the site selection process. A recommended site selection process is proposed.

Chapter 3

Conceptual Framework and Recommended Procedure for Site Selection

Introduction

The outcome of the site selection process is influenced by factors that are determined before the actual selection of sites. For instance, the formulation of the program design includes:

- -the definition of program objectives;
- the choice of a site selection procedure, and how well it is applied within the limitations of its methods;
- the definition of roles of the central authorities, technical experts, and villagers within the decision making structure.

The outcome of site selection is also affected by the definition of project "feasibility". The determination of feasibility involves the examination of the different aspects of a project (such as the technical and economic aspects), as well as the consideration of an acceptable level of uncertainty regarding project success or failure. If the decision maker is risk averse, the definition of "feasibility" will be more restrictive.

Also, site selection is influenced by the ethical framework within which it operates. Decisions about the definition of project beneficiaries, the distribution of the costs and benefits of a project among people of different income levels or generations, and the relative value of the objectives are prominent ethical issues. More subtle is the influence of ethics upon decisions regarding the choice of which impacts to study, and the interpretation of measurement results.

A model of site selection is useful in the organization and understanding of how all of the factors influencing the process fit together, as a system. This chapter will present a conceptual framework, incorporating site selection into its context: the planning cycle, the different aspects of water supply decisions, and the ethical framework. The chapter concludes with a recommended site selection process.

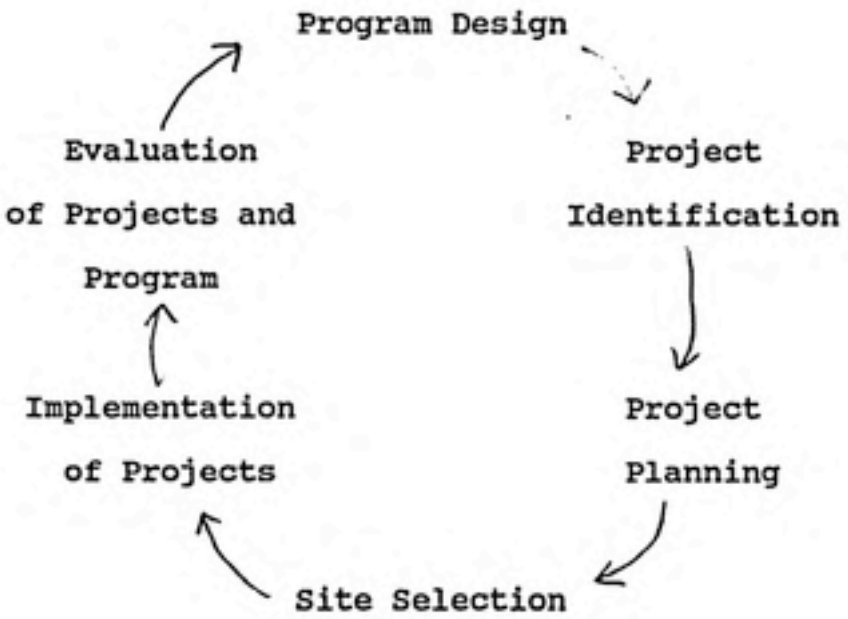
The Conceptual Framework

The process of program design and implementation has been the subject of numerous excellent treatises elsewhere. A simple model will be used here, consisting of a chain of events circling through the program design at the national level, the project identification and plan at the village level, the implementation of the projects, and the evaluation of the

projects and program. Figure 3.1 illustrates the planning and implementation cycle.

Figure 3.1

Planning and Implementation Cycle



The different aspects of water supply improvement, namely the technical, financial, economic, social, environmental, political and institutional facets, comprise the second organizational level. At each link of the process, there are decisions to be made within each facet; for example, when

working on the program design, the planners will consider all of the aspects listed above while determining the goals and objectives of the program. Actions stemming from these considerations are the tasks of planning and management. While each aspect has been tidily defined as a separate entity, in practice many of the tasks will be interdisciplinary in nature.

Accompanying the consideration of each aspect within each stage of the planning cycle, is the amount of uncertainty that can be tolerated. Within some aspects, such as the technical one, uncertainty is minimized because the behavior of the aspect has been well studied and is predictable. In other aspects, such as the social one, the outcome is more uncertain because the area is not well understood, prediction is risky, and the gathering and assessment of data in order to reduce the uncertainty is relatively expensive. Usually the explicit consideration of uncertainty is not included in site selection; however, many decisions are made to indirectly address the matter, such as the requirements for more extensive information on the aspects that are associated with greater uncertainty.

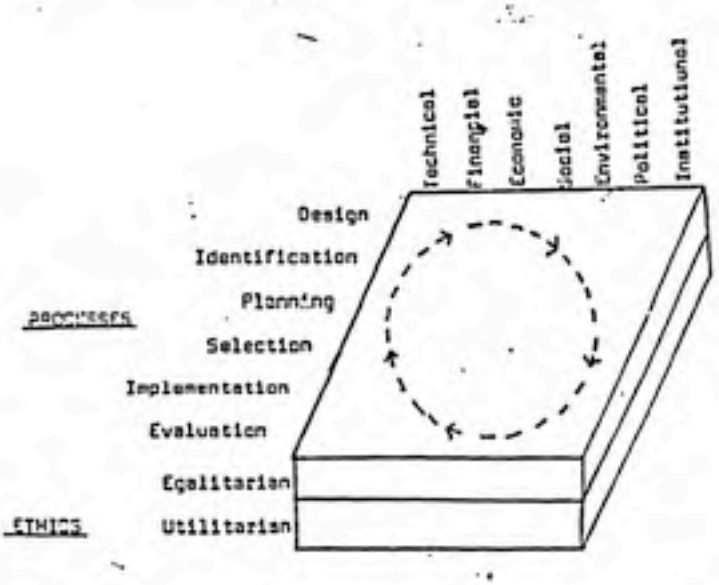
The third dimension of the model describes the ethical framework within which the system operates. Although rarely acknowledged, and even more seldom implicitly incorporated as an integral part of a decision making process, the values of people

decisively color both the outcome and the process of program development. Questions of resource allocation, such as a water supply improvement program, are often embroiled in controversy regarding the equity of distribution among peoples, between generations, and between humans and the environment. Through the explicit clarification of values regarding these issues, even if on an informal basis, potential conflict can more easily be identified and negotiated.

The general three dimensional model incorporating the process of program planning and management, the aspects of water supply improvement and two applicable ethical frameworks is presented in Figure 3.2. The dotted circle in the center of the model represents both the interactions of the aspects with each other and the cyclical nature of the process chain. A description of the ethical frameworks is given below.

Figure 3.2

Conceptual Model for Site Selection



Ethical frameworks

The ethics of distribution of a natural resource (such as water) can be described as egalitarian or utilitarian (Shrader-Frechette, 1985). The ethical presupposition of egalitarianism is that "all human beings, within and among different generations and countries, share a social contract according to which all are to be treated as morally equal" (ibid: 101). Utilitarianism is concerned with the maximization of human welfare as a group; individual sacrifices may be necessary to advance the happiness of humankind as a whole. The principle of equal treatment, as viewed by a utilitarian, "causes more human suffering than would ignoring (the poor's) welfare" and results in less human benefit in the long run (ibid: 102).

Regarding site selection, both egalitarians and utilitarians compare project costs to the expected benefits. The profound policy implications stem from differences involving:

-the determination of the value of moral satisfaction and the relationship of its value to other benefits,

-the role that existing income level plays in determining the beneficiaries of the project, and

-the allocation of costs between the central government or organization and the village.

To clarify the influence that an ethical framework exerts on these issues, a descriptive comparison of the egalitarian and utilitarian ethics is given below.

Role of moral satisfaction

The contention of egalitarianism is that the fulfillment of basic physical needs (inclusive here of water and health) is an integral part of the moral obligation of equality for all; therefore the measurement of benefits accruing from the provision* of water supplies to the needy will transcend the physical benefits and will include the benefit of moral satisfaction.

The comparison of costs and benefits is complicated by the fact that the benefit of moral satisfaction is extremely difficult to measure.

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* Because of the lack of knowledge of the causal links between the provision of an item and the satisfaction of a need, there is ambiguity in the literature regarding whether or not the actual fulfillment of needs is practical (Streeten, 1981:61). It may be sufficient to provide the opportunity to meet a need, as opposed to meeting the need directly.

In an egalitarian ethic, moral satisfaction increases with the fulfillment of needs. Consequently, a indicator of need can be used as an indicator of moral satisfaction, eliminating the necessity of directly valuing morality.

One decision rule that may be applied under this ethical construct would be to provide for the greatest "need" first, trading off need against the costs, or net benefits, of other projects. Since neither need nor cost has been sufficient in itself to ensure the sustainability of a project, additional program components to reduce the risk of failure must be incorporated in the planning and implementation process. The procedures of a political decision mode or a preconditions analysis could be applied to this purpose; the specification of minimum requirements and the allotment of complementary inputs would increase the probability of project success.

A utilitarian will choose projects on a net benefit basis (but not necessarily one arrived at by traditional cost benefit procedures), preferring the greatest yield of benefits, to whomsoever they accrue. The greatest moral satisfaction results from the maximization of net benefits to society. This influences the outcome of site selection in two ways:

- the benefits that yield immediate, rather than long term effects, will be the more valuable ones, due to the effect of discounting future benefits in the analysis; and
- the benefits that are less costly to attain will be the more valuable ones.

Economic benefit cost analysis is the quintessential utilitarian method. Political or preconditions processes can also be applied under a utilitarian ethical framework.

Effect of existing income levels

The consideration of existing income levels in the site selection process is indirectly affected through the influence of the ethical framework.

In an egalitarian framework, the most valuable benefit of a project is the satisfaction of need, and one indicator of need is the rate of water-related disease. There is a negative association between the level of existing income and the rates of water-related disease (McJunkin, 1982:94); consequently, a selection process based upon need will favor poorer communities.

Utilitarian investment generally favors groups with

relatively higher potential; since it was earlier noted that success in a water supply improvement was associated with higher levels of nutrition, sanitation, education and income (Churchill, 1987), utilitarianism will select groups which tend to be the better educated and organized, with a higher level of health and income. Benefits to disadvantaged groups will tend to be lower; although the primary benefit of time savings might be greater in these groups, an increased uncertainty of attainment of the benefits (i.e. the success of the project) might lower the estimate of net benefits considerably.

Likewise, the costs will tend to be greater for disadvantaged groups because:

- more difficult access and greater distances may increase construction costs;
- the rate of community cost recovery may be reduced;
- the disadvantaged are more likely to require complementary inputs.

If complementary investments are included as remedial measures for the disadvantaged, the costs will increase while the probability of success, while increased, cannot exceed that of the advantaged communities who have already attained the necessary level of measurement, whatever it may be (which is why these communities were defined initially as not requiring the complementary input). Determining the probabilities associated

with project costs and benefits is at this time, an exercise in educated judgement. The change in probability of program success relating to the inclusion of some complementary inputs, such as assistance in community development or health education, is particularly difficult to estimate due to the changes in human behavior that are involved.

Allocation of costs

Regarding the relative allocation of costs, an egalitarian framework would match the project to the population using complementary inputs (such as maintenance training or community organization activities) to improve the abilities of a village to implement and sustain a successful project. The costs of the complementary inputs would be borne by the program as a cost to society, not the project, and would not penalize the community receiving the inputs in the ultimate ranking scheme.

A utilitarian ethical framework would allocate all costs directly attributable to a project to that project.

In summary, a three dimensional framework for site selection is proposed consisting of the process of program planning and

implementation, the different aspects of water supply improvement, and the ethical framework within which all activities occur.

The ethical framework directly influences the consideration of the objective of reducing water-related disease. Since the amelioration of disease is a prominent goal within most, if not all, water supply improvement programs in developing countries, this ethical influence is of immediate importance. A utilitarian ethic considers the reduction of disease a benefit, and it is measured according to its cost to society (i.e., the value of the attributable loss in productivity and resources). Since the incremental cost to society on a village level has been difficult to measure, the benefit will correspondingly be valued at a low level. Due to the often negligible measured benefit, Churchill (1987) suggests that health benefits not be included at all in the analysis of costs and benefits.

Applied within the concept of need defined earlier, an egalitarian ethic would allocate water primarily on the basis of the percentage of population not having access to safe water. Therefore, attainment of the objective of reducing water-related disease would assume primary importance over the other objectives. This is in agreement with MacCormac (1981), who suggests that the allocation of air and water resources be

governed by the concept of "predistributive rights". These rights, either established through firmly established legal precedence or through moral custom assume precedence over the distribution of other goods (examples of which might be land, water quantity, or energy sources). He suggests a two-tiered system of resource allocation, the first tier being the satisfaction of the predistributive rights. All projects satisfying these rights would graduate to the second tier, where the distributive rights would then be allocated.

Recommended Site Selection Procedure

The procedures, as now applied, do not adequately address the objectives of water supply improvement. Cost analysis does not directly address any of the objectives. Political processes may also address objectives not directly related to water supply, such as the advancement of political power. Also, political processes may be inequitable, due to the tendency for the process to favor politically powerful groups. Preconditions processes, by orienting the design of projects to a list of specified criteria, may not adequately address the objective of providing a supply that the people want. The use of indices may obscure the lack of a crucial component, due to the "eclipsing" effect, and the methods of quantification of the

various objectives is controversial. Benefit-cost analysis tends to favor groups with higher incomes, and thus, does not adequately address the objective of equitable opportunity.

An improved procedure which better addresses the objectives can be proposed. The procedure recommended in this paper is a combination of a preconditions process and a modified benefit-cost analysis. This method would be an improvement over the existing methods because:

- It is equitable. Inclusion in the program is neither directly nor indirectly linked to income levels or political power.

- It is consistent with an egalitarian ethical framework. It allows for the initial choice of projects to be based primarily upon need, in agreement with the most commonly stated goal of water supply improvement - the reduction of water-related disease.

- The risk of project failure is low. The documentation of compliance with the guidelines utilizes the proven methods of social impact assessment to evaluate the motivations, preferences, and expectations of the community. In the assessment of project feasibility, the use of preconditions

also eliminates the necessity to quantify the value of social or institutional capacity in monetary or other unusual units, thereby avoiding the difficulties and uncertainty in measurement.

- Constraints within projects are clearly illuminated. This both prevents infeasible projects (as defined by the constraints) from being implemented and provides an easily understood reason (or reasons) to villagers for project rejection so that the villagers can rectify the deficiency and re-enter the program.

- The method itself is easily understood by all groups of decision-makers.

- The inclusion of the modified benefit-cost comparison provides an incentive for a project plan which reflects village preferences and capabilities, i.e., that maximizes the benefit of time savings while minimizing project costs.

No other method now in use can match all of these strengths.

At this time, due to the dearth of reliable social indicators representing motivation or the abilities of local

decision making, the site selection processes dependent upon the quantification of these elements are unreliable. Instead, many organizations (including the U.S.A.I.D. and the World Bank) have recommended the use of extensive checklists. While the lists cannot provide a quantitative account, they can guide the decision maker(s) through a complex system of issues, ensuring that all issues are considered. For these reasons, the use of a checklist, specifying the preconditions necessary to reduce the risk of failure within a project to an acceptable level, is suggested.

The exact preconditions to be proposed will be dependent upon local conditions. As an example of possible preconditions, a suggested list of criteria in each aspect of site selection is given in Figure 3.3.

Figure 3.3

Preconditions Guidelines

Technical

The project is technically sound and is suitable for the site's terrain and other natural resources. It addresses the perceived needs of the village at a level of service acceptable to the users. Parts, supplies and fuel are readily available and a plan has been established for procurement. Technical expertise capable of operating and maintaining the technology (on a routine basis) is available locally or a plan has been established to train personnel in the necessary skills. Expertise is available within the region to perform major maintenance tasks.

Financial

The village has a financial management plan for the system. This plan includes estimates of the financial costs of construction, operation and maintenance and designates the costs that the village is responsible for. It establishes a rate structure or other cost recovery method, detailing the costs expected to accrue to the users. Users accept the responsibility for payment of these costs and agree to abide by the penalty system for non-payment established by the water supply institution.

Economic

The village is willing and able to pay the operation and maintenance costs of the system and the applicable share of the construction costs detailed in the program plan. The land, material and labor contributions are accepted by the community.

Social

The village, especially the women or the primary users, approves of the water supply plan. They are willing and able to provide the land, labor, material and financial resources necessary to construct, operate and maintain the system. The village accepts all responsibility for the system and approves of the administrative structure established to organize, activate, operate and maintain the system.

Precondition Guidelines, continued

Environmental

Environmental impacts from the project have been assessed. Impacts not acceptable at the program or project level have been mitigated. Regional impact mitigation have been negotiated at the regional and national levels.

Political

Administrative structure and power is accepted by the community and does not conflict with regional or national authority. The land on which the system is located is freely given for this purpose, and is not involved in land tenure disputes.

Institutional

The village has established an institution in compliance with the program's directives. This institution is responsible for the management of the village's inputs (materials, labor, funds, and decisions) in the planning, construction, operation and maintenance of the system. Responsibilities and methods for the management, collection and disbursement of revenues and costs and the procedure for assessment and enforcement of penalties for nonpayment are clearly delineated. The village accepts the institution and agrees to abide by its policies.

The preconditions are used to designate the beneficiaries of the program, and to establish a minimum level of performance necessary to ensure a reasonable likelihood of success (as determined by the central authorities).

The benefit-cost analysis is the better method to assess village preferences, and is most likely to result in designs at the local level that reflect the desires and conditions of the villages. The benefit that is measured within the analysis is the time savings resulting from the water supply improvement. This one measure indirectly reflects three of the four user-perceived benefits most often mentioned as valuable, i.e. accessibility, reliability, and quality. Much has been written upon the valuation of time, and the choice of a method will be dependent upon the country's circumstances (such as what the time may be used for, whether there is water vending in the areas, etc.).

Determination of project costs is relatively straightforward, and has been described extensively elsewhere (Lauria, 1988; Overseas Development Administration, 1985; Saunders and Warford, 1976).

One problem of benefit-cost analysis is its tendency to favor higher income level groups, thus not allowing equal

opportunity for investment. The comparison of projects between relatively homogenous groups of villages minimizes the effects of income upon the estimation of benefits and costs. It is suggested to stratify the comparison of net benefit among the different projects by socioeconomic status. The stratification of socioeconomic strata within each region of the country will further facilitate equitable opportunity to investment.

In the program design stage of the planning cycle, an allocation of funds can be made between the socioeconomic strata and the regions by political actors.

To summarize the recommended procedure:

1. A preconditions process is used to formulate criteria directing investment towards villages with the greater rates of water-related disease. Criteria also specify the minimal level of performance necessary for project feasibility.
The comparison of projects is stratified by socioeconomic status, and possibly also by region, in order to allow the opportunity for investment to villages of all income levels.

2. The villages apply to the central authority for inclusion in the program. The village is assessed by a technical expert using a health indicator suitable to the conditions, depending on the type of disease prevalent in the

area and the availability of records. If the rate of the chosen indicator meets or exceeds the criteria established in the program design, the village proceeds to the project planning stage.

3. Once the project plan has been formulated, it is compared with the program criteria. If any of the preconditions are not met, the project is rejected and the village notified unless the plan contains a provision designating the need and proposed use of a complementary input necessary to meet the condition. Upon satisfaction of the conditions of the precondition, the village can resubmit the project for further consideration.

4. The requests for complementary inputs necessary for successful project construction and implementation are analyzed. If the inputs required are not available under the program, the project is rejected and the village is notified. One example is the possible requirement for an all weather road, necessary for the delivery of supplies; this input may or may not be a part of the program. If the input is available, the project receives it and is re-evaluated for the precondition at the conclusion of the input.

5. The benefits and costs of each project meeting the preconditions are estimated. The benefits are measured as the

resultant time savings and the costs are measured as the costs directly attributable to the project: the cost of labor, materials, technology, transportation and communication. The net benefit of the project is calculated. Comparison of the net benefit within the socioeconomic strata is made, with the projects yielding the greatest net benefits receiving the highest priority within the strata.

6. Projects are approved in order of priority until the budget is depleted for all socioeconomic strata within the region. Administrative changes of construction scheduling within the pool of priority projects are permitted to facilitate the transportation and utilization of time, labor and materials.

7. The procedure continues in the next region.

Relationship to the conceptual model

Prior to the site selection procedure, the program is designed, and the projects identified and assessed, through the process chain suggested in the conceptual model. Of particular importance is the designation of a structure for decision making, and the establishment of the opportunities and responsibilities of community participation.

The recommended procedure delegates extensive decision making power to the local level; however, ultimate authority rests with the central unit.

The village is responsible for notifying the central unit (either government or organization) of their interest. If accepted into the program, the village proceeds with the collection of data and the formulation of the project plan, to be used in the assessment of project feasibility and the measurement of benefits and costs. Technical assistance is available upon request from the central unit. The village is also responsible for requesting any complementary inputs that may be necessary for the project to meet the feasibility criteria.

The central unit evaluates the project plans as to their feasibility, using a pre-determined checklist. Validation of the village information through a field visit is prudent. The valuation of the time-savings and the project costs is centrally performed, based upon the information provided in the village assessments. Finally, the ranking of projects within the socioeconomic strata is performed on the central level.

All aspects of water supply development are considered in

the evaluation of project feasibility. Attention has been focused throughout the process upon meeting the objectives important to site selection, as suggested in Chapter 1. Figure 3.5 is a general decision chart integrating the suggested site selection procedure with the conceptual framework.

The ethical framework suggested is primarily an egalitarian one. As mentioned previously, the overriding goal of water supply improvement is to reduce the morbidity and mortality due to water-related disease; therefore, it is reasonable to pursue an egalitarian ethic investing first in sites with the greatest extent of documented water-related disease.

However, the presence of water-related disease is not a sufficient condition to ensure a reasonable probability of a successful project. To directly address the needs and desires of the villages, it is necessary to consider other benefits accruing from water supply improvement, namely the user-perceived benefits. Furthermore, the inclusion of these benefits as an element of the final decision rule will also address the needs of villages not severely impacted by water-related disease but still experiencing an unacceptable lack of water due to problems with reliability, accessibility, quality, and quantity. Therefore, both the primary need of reduction in

water-related disease and the secondary need of the provision of better access are the major needs to be considered.

Relationship of the procedure to the objectives

The recommended site selection procedure addresses all of the objectives of water supply improvement:

- The beneficiaries of the program are initially identified through the use of health status indicators, and the program can be expected to reduce the incidence and/or severity of water-related disease.
- The consideration of user-perceived preferences is both the foundation of a benefit-cost assessment, and a precondition necessary for project feasibility.
- The measured benefit in the benefit-cost analysis is the time savings in the collection of water. The provision of better access will result in greater time savings.
- The incorporation of community participation, the assessment and mitigation of environmental impact, and the design of water improvements that are financially feasible are all preconditions of project feasibility. In conjunction with the other preconditions, an acceptable level of project success is specified.
- The equitable access to opportunity for water supply improvement is addressed through the stratified

analysis, by socioeconomic status and region, of the costs and benefits of all projects. Also, the beneficiaries of the program are defined by need, rather than political power.

Summary

Site selection is a process occurring within a larger system of water supply management. A conceptual model is proposed in order to better understand the relationships between site selection and other system components. The first dimension of the model is the project planning and implementation cycle. The second dimension is the consideration of all of the aspects of water supply improvement, namely the technical, financial, economic, social, environmental, political, and institutional aspects. The third dimension is the ethical framework within which all decisions take place.

The site selection processes, as now applied, do not adequately address the objectives of water supply improvement. A recommended procedure is a combination of a preconditions process and a benefit-cost analysis. The preconditions specify the intended beneficiaries of the program through the use of health status indicators; also, a minimum level of performance can be established in all of the aspects of water supply improvement. Benefit-cost analysis presents a comparison of

costs and benefits at the village level. A stratified analysis of net benefit, on the basis of socioeconomic status and by region, reduces the effect of existing income on site selection.

Chapter 4

Summary

There are five approaches to site selection now in use: cost analyses, political processes, preconditions processes; indices; and benefit-cost analyses. Because a rigorous evaluation has not been done of the performance of the different procedures, the potential performance of the methods must be estimated through the examination of the following questions:

- Which objectives are addressed?
- How are the indicators measured?
- What is the relative value of the objectives, and who determines it?
- What is the role of the village in the decision making process?

Four specific differences between the procedures are of particular importance:

First, the consideration of the objective regarding equitable access to the opportunity for water supply improvement is not included within each procedure. Cost analysis excludes the consideration of equity, and the rest of the procedures may or may not include it, depending upon the program design. Of

greater concern is the possibility within three processes - the political processes, indices and benefit-cost analysis - of indirect bias against communities of lower income. This bias arises from differences both in costs (due to poorer access and to the lesser availability of supplies, materials and labor), and in benefits (due to the association of affluence with greater probability of program success).

Second, the methods for quantifying the different indicators of the objectives are variable in their validity. The estimation of health status indicators, cost, and the value of time savings is based upon a considerable body of research and experience, and the methods of measurement are established. Conversely, the quantification of human behaviour is associated with greater uncertainty, due to the lack of consensus among investigators regarding which indicators are most valid, and what is the best method of measurement.

The failures of projects within the sector are most often attributed to factors of human behaviour, such as an ineffective institutional framework, a lack of community participation, or inadequate training for system operation and maintenance, rather than to poor estimates of health impacts, costs, and time savings. Therefore, the accurate prediction of human behaviour is a necessary component of site assessment. The established

methods of social assessment, i.e. questionaires, interviews, and observation, are expensive approaches to the estimation of behaviour, but are more valid than the use of other methods. Therefore, social assessment is a more valid approach to the estimation of behaviour than the assignment of a numerical or monetary unit to behavioural outcomes. .

Third, the procedures for site selection, as applied in the examples given previously, delegate the larger responsibility for decision making to the central government or organization. The provision of a water project that the villagers want, and are able and willing to finance and operate, is the goal of many programs; however, the site selection procedure presents limited opportunity for decision making responsibility at the village level. This limitation to village participation may result in projects that are better suited to the requirements of the central unit as opposed to the desires, needs, and environmental setting of the villages. Also, excluding the village from the control of the planning and implementation stages limits the opportunities at the local level for managerial training and institutional development (including the building of credibility in the eyes of the future users).

Recommendations

The site selection procedure best suited to meeting all of the objectives, in an equitable and creative manner, is a combination of a preconditions process and a benefit-cost comparison.

Preconditions are used to both identify beneficiaries on the basis of need, and to specify a minimum level of project feasibility.

A benefit-cost comparison is made among the pool of feasible projects, to identify the projects yielding the greatest net benefit. Since the benefit is measured in terms of time savings, it is reflective of the perceived benefits at the village level. Comparisons between projects are made within a stratified analysis, stratified on the basis of socioeconomic strata and average income levels, in order to reduce the influence of income level or political power.

Suggested Research

At this time, the crucial links between knowledge and understanding are weak. Research is needed on:

- the question of the importance of the different aspects of water supply investment, relative to each other

- possible synergistic reactions between factors

- the validity and precision of the health status indicators in relationship to water-related disease

- the role of environmental protection in water supply investment and its social costs and benefits

- identification of social indicators representing community motivation and organizational capacity

- relationships between the provision of complementary inputs and the probability of affecting the outcome of a water supply investment

- assessment of acceptable levels of risk of failure.

Appendix 1

Identification of Current Issues in Rural Water Supply

The IDWSS Decade has fostered a proliferation of program evaluations and planning manuals, each illustrating some of the many possible outcomes of different investment strategies. Considered together, the evaluations establish patterns of the important issues influencing project success that may be entered into the process of site selection. As discussed in the literature, the issues most relevant to the site selection process are:

Benefit estimation

Past investments in the water supply sector have been based upon expectations that water improvement will ameliorate unhealthful conditions and facilitate economic growth. The realization of benefits within these categories have proven problematic.

The promotion of health benefits is the most common goal of water sector investments. The IDWSS Decade declarations assume that water supply improvements will lead to substantial health benefits. Correspondingly, donors and private voluntary agencies

have traditionally stated the primary goal in water and sanitation projects to be the production of health benefits (Iseley, 1986:6).

However, both the attainment and the measurement of health benefits are complex and the early evaluations of health impacts were perplexing. A landmark study by Feachem et al (1978) determined that Lesotho villages with improved water supplies were similar in the distribution of diarrhoeal disease and infectious skin disease to other villages using traditional water supplies. Basing the statement upon this study, the Overseas Development Administration concluded that "... no measurable reduction in water-related disease has resulted so far from [improving] village water supplies. It is possible that benefits might result were other health measures to be implemented together with water supply improvements." (1985:89).

Recent research, including further work by Feachem, indicates that improvement of water supply alone unaccompanied by other purposeful interventions does have a measurable impact upon health albeit a much lesser effect than that estimated in past water supply investments. The Diarrheal Diseases Control Program concluded there are some measurable reductions in morbidity and mortality due to diarrhea as a result of the use of improved water supply and sanitation (Esprey, Feachem & Hughes,

1985). Typical impacts of improved water supply and sanitation conditions on diarrheal morbidity are illustrated in Figure 1.1.

Figure 1.1

Effects of Improved Water Supply on Diarrheal Morbidity

	Mean reduction in Diarrheal Morbidity
Improved water quality	16%
Improved water availability	25%
Improved water quality & availability	37%
Improved excreta disposal	22%

Source: Esprey, Feachem and Hughes; *Bulletin of the World Health Organization*; 63(4) 1985; pp 757-772.

One reason the relationship between water and health has proven difficult to demonstrate is that water is known to be a necessary condition for health, but good water quality alone is not sufficient for the realization of substantial health benefits (Carruthers, 1973). Diseases affected by water supply are transmitted in a variety of ways - water borne, water washed, and water based - and may be associated with vectors (malaria) or minerals (excessive fluoride). Also, personal and household hygiene practices may contaminate water supplies between the tap

and the use. Due to the interactive nature of water with these other variables, other elements are ideally present to facilitate full activation of the health benefits. For example, community participation and hygiene education promote the effectiveness of water supply and sanitation (Okun, 1987:35). Other factors which interact with the provision of safe water to maximize health benefits are nutritional status, sanitation practices, income levels, and educational levels. One policy statement elucidated "Improvements in health are highly correlated with literacy, level of female education, and income, rather than the level of water and sanitation services." (Churchill et al, 1987:ix). These statements imply that human behaviour, rather than the physical provision of an improved water supply, has been the primary factor in the actualization of major health benefits .

Economic development has been another objective of water supply improvement, either through agricultural development or through income redistribution schemes.

Redistribution of income is often approached through a water supply investment objective. The 'worst first' strategy directs investment to those villages considered "worst off" by whatever indicator is being used, usually one of poverty or energy expenditure. One such program, ranking the worst off based upon distance to the water source, worked well in Thailand in reaching

the poorer villages first, because villages farther from water tended to be smaller and more poor than average (Saunders & Warford, 1976:105). Most programs, however, have built in bias in the selection process that excludes the very poorest villages. Contributions of money, labor or both in construction and operation, and poor organization or low political power may exclude the poorest. For these reasons, the 'Worst first' strategy is a high cost and low probable-payoff venture. (Saunders & Warford, 1976:105ff).

Another method of income redistribution, subsidies, reach "primarily those of greatest influence and least need" (Saunders & Warford, 1976:106). An evaluation of a Zimbabwe sanitation program (financed through urban to rural subsidies) found that only 16 % of people with less than average incomes benefitted from the subsidized latrine programs, while 55 % of the richest decile benefitted (World Bank, 1987:18). Another subsidy strategy, the growth point concept, is founded upon the spatial concentration of governmental resources to create points or centers of rapid economic growth. Commonly used in urban situations, this strategy has not been successful in rural development, as the complementary investments necessary for significant economic development are often lacking (Saunders & Warford, 1976:102).

In summary, while water supply is usually necessary for the realization of significant health impacts and economic development, it is not sufficient by itself to induce benefits on the scale previously anticipated. Improved methods of benefit estimation in the field of health through the use of case control studies has been suggested by Briscoe (1987), and further research is anticipated.

User preferences

Compounding the sometimes modest yield of health or economic benefits, is the disinterest in these benefits on the part of local villagers. If the project does not provide user-defined benefits it is unlikely to be valued by the villagers, the final result being abandonment or misuse. Accordingly, the consideration of user defined benefits is emphasized in recent publications (Churchill et al, 1987; Grover, 1983; World Bank, 1987).

Drawers of Water (E.F. White et al, 1972) was the first publication to define and analyze the criteria important to local people. The authors suggested that villagers' preferences regarding quantity, reliability, access, and quality be included in any feasibility studies.

Recent authors have expanded on the mere inclusion of preferences, calling for the prominence of local preferences in the decision making process. In this model, the government fulfills the role of facilitator and intermediary, assisting with technical and organizational expertise as the communities define and implement the project. The World Bank has concluded that the best projects are those that people want, and are willing and able to contribute their resources to build and maintain (World Bank, 1987; Churchill et al, 1987), the implication of which is that user-defined preferences are the foundation of the planning and management process.

The challenges that arise when user-defined benefits are given prominence involve difficulties in measurement of the benefits and in the mitigation of the conflicts that may arise among groups of decision makers. Direct benefits of water supply investment are usually entered into the analysis through the valuation of time saved* in the collection of water, but other direct benefits such as reliability and convenience of service, and changes in taste, clarity, and odor are often not counted due in part to difficulties in quantification. Assessment of the economic concept of "willingness to pay" is one way that these preferences can be quantified. Advances in the field, primarily in the understanding of bias in direct surveys, has increased the potential for the technique in the assessment of

demand (Whittington, D. et al; 1987).

Conflicts among users may arise during the planning and implementation of projects, as user-defined benefits may not coincide with those defined by government, donors, or even local interest groups such as system operators. For example, it is not uncommon for a conflict to arise between the government's goal of provision of a bacteriologically pure supply and the village's preference for chlorine-free water. Barriers to successful negotiation may be present due to lack of information or interest and to imbalances in power between program/project management and the system users.

Cultural roles may hamper the identification of preferences. Women particularly benefit from improved supplies, since they are the population group most likely to be the major household users and the gatherers of water. Time savings resulting from an improvement can be substantial; in Lesotho, 30% of the families spend more than 2 1/2 hours a day fetching water while in East Nigeria, collection can take up to 5 hours per day. Therefore, women may value water improvement more than men*. Yet when the preferences of village people are sought, elders or chieftains

* The valuation of women's time is controversial as the time saved may not be utilized in an income generating activity; instead, it may be used for home tasks, child rearing, or leisure, all of which are difficult to value monetarily.

(generally men) are often interviewed, not women. Therefore, the preferences of women may not be identified.

Community participation

Community participation, including cost recovery , is an important indicator of project success (Hewitt & Becker, 1986; World Bank, 1987). Regarding the need for cost recovery, water in rural areas has generally been provided at no cost but the extensive proliferation of new projects coupled with the increased operation and maintenance expenditures to be expected from the "aging" of the water supply projects has posed a tremendous challenge to national budgets. For example, India's national annual expenditure for the 300 million using handpumps and the 200 million using piped water is Rs 9200 million (US$ 900 million) (van Wijk-Sijbesma, 1987). Since donors generally fund only capital improvements, leaving the financing of recurrent costs to countries, cost recovery at the community level of at least the operation and maintenance costs is essential. As the World Bank succinctly states, "Excessive dependence on subsidies from outside the community has led too often, in practice, to outcomes that are inadequate, inappropriate or unreliable from

* This is illustrated in a study from Zimbabwe, where women are willing to pay 40% more than men for an improved water supply (World Bank; 1987:21).

the community perspective, and unsustainable from the national perspective" (World Bank, 1987:i).

Is a cost recovery policy in conflict with a basic needs policy? Perceptions regarding the ability to pay on the part of local villagers are changing. Most developing countries assume that rural people can pay little or none of the costs of improved supply, often collecting little or no data to support this assumption. Yet, in China villages are expected to pay 90 to 100% of the capital and 100% of the recurrent costs; the systems are well operated and maintained. Even very poor households have resources of time and labor, and it is estimated that these contributions can generally be given without forcing the household below subsistence minimums (Churchill, 1987:7).

The term "community participation" has often merely referred to the village's participation in the program as beneficiaries and laborers; little or no responsibility for decisions was involved. Paradoxically, the provision of a water supply improvement that the villagers want and will support financially and managerially is the goal of many programs, yet a lack of community participation has repeatedly been a primary cause of failure.

Technology issues

Emphasis regarding technology issues in the recent past has been centered on the concepts of "appropriate technology", resulting in a reduction of problems regarding lack of spare parts and/or fuels. Controversy over the word "appropriate" has focused attention on the choices regarding level of service and the development of technical expertise locally.

Some people have concluded that 'appropriate technology' means in every case the simple, low cost option will be best; however, communities may perceive that existing sources are as good, if not better, than the simplest technological choice. For example, in northeast Thailand, two projects (handpipes and standpipes) failed because the technologies offered were perceived to be no better than the traditional choices. A third project, supplying the people's choice of yard taps, resulted in 80 % of the people being served and 90% of the systems were functioning reliably, even though the people agreed (and were paying) more per liter than in Bangkok (Dworkin, D., 1980).

Institution of cost recovery at the local level is impacting technological choices, sometimes in unexpected ways. People may be willing to pay more for an increased level of service. In Malawi, the people were prepared to make major contributions of time and money for a piped system, even when the travel time to

the water point is not reduced (World Bank; 1987:11). Conversely, if the technology chosen is perceived to offer an unsatisfactory or unchanged level of service, people likely will not be willing to pay anything for the "improvement" - a problem facing countries where previous water supply programs were governmentally subsidized while new programs must be based upon the principles of cost recovery.

Institutional Issues

A growing trend exists in the donor/lending community towards assessment of institutions and problems (Barnet and Engle, 1985) because organizational autonomy, or lack thereof, the absence of maintenance systems and policies, and political rivalry may thwart the best conceived program.

A plethora of organizations and interests interact in the web of decisions entailed in a water improvement project, including the national government; intermediate level government(s) (regional, district, tribal); donor agencies, responsible for the funding; technicians, local and/or expatriate, involved in the design and implementation of the project; and finally, the users who will ultimately consume and possibly control the project. Political actors and technical experts usually dominate the process (Isely, 1986:5), even though a lack of local responsibility is generally linked with

failure of sustainability of programs. Besides the aforementioned problems resulting from the elimination or non-consideration of options that users desire, conflicts may arise involving unrealistic construction standards* or through the rapid expansion of a program, assuring political support, before technology and logistics are operable (Glennie, 1982:5).

Similiarly, the community participation projects involving self help institutions have been a questionable success. Institutional disarray has hampered initiative, resulting in a recognizable sequence of action in many developing countries - embrace of the concept; experience of difficulties in administration; and abandonment of the project, due to governmental difficulties in response and control of community initiatives (Schaffer, B.B., 1969).

Environmental protection

Surveys of the environmental aspects of water supply improvement are often confined to identification of localized effects on drainage and vector habitat, and on source characteristics such as flow rate, quality, and yield as these are the characteristics that directly affect the provision of

* In Togo, project plans detailed a fully brick lined latrine. The cost of $400/ea limited construction to 1 per village (Iseley, 1986:6).

water at the supply point. Drought planning (and the technological and administrative changes that it entails) also affects the provision of the supply at the source and is increasingly included in water supply investment plans.

In addition, regional or watershed effects can result from projects. Although often far more serious than the localized effects, regional effects were not considered in any paper reviewed by the author. Documented regional effects of water supply development include:

- water hole congestion leading to soil compaction and depletion of vegetation,
- altered patterns of settlement,
- depletion of groundwater reserves leading to failure of wells (and possibly to desertification),
- salinization
- biological or chemical contamination of the underlying aquifer.

Summary

In response to the disappointing progress made during the IWSS Decade, the literature is filled with calls to redefine the objectives and to develop sustainable strategies for water supply development. Several issues have repeatedly arisen in the

planning and evaluation of water supply improvement programs including: the difficulties in quantification of health and economic benefits, leading to a re-evaluation of their role in water supply planning; the prominent rise of the consideration of user defined benefits; the importance of community participation and its implications regarding project control; a need for more effective organizational action in the planning and provision of service; the challenges present in choosing an appropriate level of service, balancing consumer expectations with technological and cost constraints; and the broadening of the environmental sphere from the consideration of only local impacts to those of a regional level as well.

Appendix 2

Cross-sectional Review of Recent Project Evaluations

The general literature of rural water supply in developing countries is founded upon information garnered at the field, or program level. The field reports, identifying the individual problems and successes of programs, are compiled en masse to yield a cross-sectional view of the state of the sector as a whole, which is then reported and expanded upon in the general literature to yield recommendations for future actions.

The compilation of the field reports is generally done on an informal basis by the planner. Without self-imposed controls which limit the influence of information bias, the insights contained within and between the reports may be distorted by the influence of the planner's prior information, views or experience. This study utilizes the method of key word analysis to compile a cross-sectional review of recent program evaluations with a minimal level of researcher-induced information bias.

The report concludes with a comparison between the results of the study and a listing of current issues in rural water supply improvement taken from the general literature (as described in Appendix 1).

Methods

The reports used in the study are in the published series of Water and Sanitation for Health (WASH) Field Reports, received as of August 4, 1988 by the International Studies Office of the University of North Carolina (a WASH library repository). Individual reports were chosen according to criteria designed to focus the study on individual rural programs currently in operation. Only those evaluations addressing all aspects of a program were included. The following criteria were used:

1. Document must be an "evaluation", "review", or "report" (as denoted in report title and/or executive summary.

2. Program was operational at the time of the evaluation.

3. Program served a rural or village population (as self-identified in report).

4. Report is of a water supply or water supply and sanitation program within a single country.

5. Report addresses a program in its entirety, and not just one or two aspects (such as technology, finances, or educational components).

20 reports satisfied all of the above criteria.

The listing of site selection issues was drawn from informal review of the general literature, and is the subject of Appendix 1. These site selection issues are presented in Figure A2.1.

Figure A2.1 - Site Selection Issues

Health impacts
Economic impacts
User perceived benefits
Community participation in operation and maintenance
Cost recovery
Level of service
Institutions involved in operation and maintenance
Technological issues
Environmental protection

Information regarding the issues listed in Figure A2.1 was identified, coded as to content, and tabulated. To reduce information bias, information was identified within the reports through the use of keywords. Within each issue category, a list of keywords addressing that category was established prior to the literature search. The presence of one or more of the keywords in a report was noted, and was coded as being either "a problem/

not a problem", "an impact/ no impact", or "participation/ no participation" depending upon the context of the keyword. Additional information describing the specific problems within key word categories was also collected using keyword qualifiers. All keywords are listed in Figure A2.2, included at the end of the paper.

Results

Results of all categories were tabulated and are presented in Table A2.1.

Institutions for operation and maintenance were mentioned most often in the evaluations, being included in all 20 reports (one report was inconclusive). Of the 13 denotations of problems, 5 evaluations described local institutional problems and 2 evaluations described central administrative problems (the remaining cases not mentioning the type of problem). The 7 reports of no problem included 6 reports of local and 5 reports of central institutions.

Community participation was the second most mentioned category, being included in 14/20 (construction) and 16/20 (operation and maintenance) reports. In the construction category, 4 reports mentioned there was an absence of

Table A2.1

Keyword category	Survey Results*		
	Impact	No impact	Not mentioned or inconclusive
Health impacts	6	2	12
Economic impacts	4	1	15
User-perceived benefits	8	3	10
	Included	Not included	Not mentioned or inconclusive
Community participation-			
construction	10	4	6
o. and m.	8	8	4
	Problem	No problem	Not mentioned or inconclusive
Cost recovery	5	6	9
Level of service	1	4	15
Institution for o. and m.	13	7	1
Environmental protection	4	0	16
Technology	7	5	9

* Note: Some reports are included in more than one survey results category.

participation. Of the 10 reports mentioning the presence of participation, there were 7 references to provision of materials, 7 references to provision of labor and 4 references to participatory decision making. In the operation and maintenance category, 8 reports mentioned an absence of participation. Of the 8 reports of participation, 3 mentioned the provision of labor and 4 mentioned participatory decision making.

Health impacts were mentioned in 8/20 reports. Of the reports noting impacts, 2 reported a measurable impact (1 report on typhoid, the remaining report not documenting specific impact) and 4 reported a perceived impact (2 reports of diarrheal reduction and 2 reports of general disease reduction). 2 reports mentioned that there were no impacts.

User perceived benefits were considered in 11/20 reports. Of the 3 reports not perceiving any benefits, 2 documented problems with water quality and 1 documented a problem with decreased reliability. The 8 reports mentioning the realization of user-perceived benefits included 5 references to better accessibility, 2 references to better reliability, 3 references to better quality and 1 reference to increased quantity.

Cost recovery of operation and maintenance costs was included in 14/20 reports. 6 reported no problems (4 projects

were community financed, 1 project subsidized, 1 project jointly financed). Of the 5 reports of problems, 1 system was subsidized and 4 systems were community financed. 3 reports mentioned inconclusive results (an example of which might be "too early to tell").

Technology was mentioned in 16/20 reports. 7 reported problems, 2 of which noted design problems and 2 noted problems with the procurement of supplies. 5 reports noted that the technology was satisfactory. Interestingly, 5 reports mentioned that technology was a potential problem in the future but not at the current time.

Environmental protection, level of service and economic impacts were mentioned in 25% or fewer of the evaluations (16/20, 15/20 and 15/20 respectively).

Discussion

Of the keyword categories considered, the most frequently mentioned were institutions for operation and maintenance, and community participation. This result is in agreement with the reports given earlier in this paper. However, technology was a surprising third in importance. Possibly a reflection of both the ease of quantification and of the professional qualifications

or interests of the evaluators, it was not possible to delineate between major and minor technological difficulties. Further research evaluating the impact of the appropriate technology movement is needed.

Impact measurement of health and economic impacts was mentioned in 40% and 25%, respectively, of the reports. This indicates that the evaluations as a group were evaluating the means to the end, and not the expected end result itself, perhaps due to the difficulties inherent in the evaluation of these benefits.

The least common concerns were environmental protection and level of service.

The reports included in the survey were not a random sample from the pool of all evaluations. The evaluations used were all WASH reports, which describe U.S. Agency for International Development projects. Therefore, results drawn from the study are only applicable to U.S.A.I.D. projects. Also, evaluations of reports are generally biased towards the selection of failing projects, rather than successful ones, and thus the problems, or lack thereof, are not representative of the pool of all possible project outcomes.

Figure A2.2: Keywords for the Identification of Content

Health impacts	health disease diarrhea guinea worm dracunculiasis cholera typhoid
Economic impacts	economic agricultural industry home industry craft livestock
User perceived benefits	community needs felt needs perceived needs perception accessibility reliability quality quantity
Community participation	community participation labor materials planning
Cost recovery	cost recovery charges tariffs subsidy ability to pay willingness to pay
Level of service	level of service
Institutions for operation and maintenance	institutions organizations management system management agency administration committee
Environmental protection	environment

vector
drainage
pollution
source depletion
protection of quality
effects on animals/plants

Technology

spare parts, supplies
fuel
performance

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