WATER AND SANITATION FOR HEALTH PROJECT

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SOCIAL AND ECONOMIC PRECONDITIONS FOR WATER SUPPLY AND SANITATION PROGRAMS

WASH TECHNICAL REPORT NO. 10

NOVEMBER 1981

Prepared for:

The Office of Policy Development and Program Review
Bureau for Program and Policy Coordination
U.S. Agency for International Development

CDM FIVE is operated by Camp Dresser and McKee Incorporated; Principal Collaborators: Center for Educational Development in Health, Boston University; International Science and Technology Institute; Research Triangle Institute; University of North Carolina at Chapel Hill.

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Prepared for the Office of Policy Development and Program Review
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by

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EXECUTIVE SUMMARY

This paper is intended to assist development planners in understanding the social and economic characteristics, or preconditions, that influence the outcomes of programs for the establishment of community water supply and sanitation projects. Overall program development consists of a continuous cycle of planning, implementation, and evaluation. This paper, however, concentrates on the early stages of broad program formulation and the constituent project identification. The role of preconditions in these early stages can be viewed as a series of five subassessments starting with the definition of the problem, then proceeding to the determination of community characteristics, available technical interventions, and necessary resource interactions, and ending with the prediction of likely program outcomes.

The overall purpose of the report is four-fold: (1) to determine the nature of social and economic preconditions, (2) to review the range of preconditions described in the development literature, (3) to develop a model to aid in understanding preconditions, and (4) to recommend operational quidelines for the identification of preconditions in the field.

Project identification is based upon the assumption that it is possible to predict the future consequences of proposed projects. Impact studies constitute formal methods of assessing these consequences in a wide variety of physical, behavioral, and health areas. Over the past one hundred years, impact studies have been the primary source of cur-

rent insights into the developmental consequences of water and sanitation projects. Early studies concentrated on public health impacts, but more recent work has stressed the multidisciplinary aspects of the development process. Impact studies of water and sanitation projects in developing countries, however, have been carried out for only the last quarter century. During this time, particular attention has been focused on the concepts of time savings, causal linkages to health benefits, and the hierarchical ordering of impacts. Because of problems of experimental control in all pre-existing communities, most of these studies have had difficulties in validating their research hypotheses. As sources of information, however, they have greatly contributed to an improved understanding of the development process. This has led to more sophisticated planning approaches which now incorporate elements of social soundness, economic analysis, and environmental assessment.

In general, the literature on impact studies shows that (1) no impacts are universally found in all studies, (2) impact interactions are sufficiently well understood to allow the development of preliminary planning models, and (3) the provision of water and sanitation facilities alone is not sufficient to produce significant benefits.

Preconditions for successful water and sanitation programs are considered to be the existing conditions and constraints, as well as the associated complementary investments, necessary to overcome the constraints. Successful program formulation and project identification is dependent upon an accurate recognition of limiting conditions and constraints and a carefully tailored package of corresponding complementary investments.

An understanding of the role of preconditions is enhanced by the use of social analyses, which have become an essential part of most planning methodologies. The concept of basic needs is becoming increasingly important in the development of water and sanitation policies. Procedural tools to make rapid social assessments take the form of indicator variables, checklists, and indices, such as the Physical Quality of Life Index. Although the process of project identification is still in its infancy, the World Bank and USAID have developed preliminary guide lines for the initial phases of project planning.

Recent investigations have suggested that the socioeconomic status of a community is a key precondition to the occurrence of health benefits from a water and sanitation project. Health benefits are less likely to occur at both the high and low ends of the socioeconomic spectrum than at the crucial middle level where infrastructural and institutional factors tend to support a more effective use of water and sanitation interventions. Similarly, socioeconomic conditions are determinants of the appropriate levels of technology that should be considered. Where necessary, complementary investments must be made to overcome limitations or to provide further assistance to the water and sanitation effort. Such investments may include hygiene education, maintenance training, institutional development, infrastructural improvement, and managerial strengthening. The literature on preconditions clearly shows that

(1) the use of social variables in water and sanitation planning is new and still unproven and (2) there is growing recognition of the importance of considering basic needs, support programs, relative levels of development, range of technologies, complementary investments, and anticipated benefits in the planning process.

A successful water and sanitation program is one that achieves the objectives for which it was planned. The following five-step model of program preconditions is proposed for program formulation and project identification:

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 the 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.

Each step should be reviewed in its proper sequence before proceeding to the next category. Thus, the assessment of preconditions involves a process of decision-making in a number of key areas. The total process leads to the formulation and final selection of water and sanitation programs with a high potential for ultimate success.

The paper concludes with suggestions for the most important preconditions in each of the five main steps, as well as recommended procedural guidelines for the application of the preconditions model in the field. The emphasis here is that general preconditions can not be determined for all areas. Depending upon the size of the intended program, each area will require some custom fitting. It is recommended that relatively small areas with well-defined water and sanitation programs be tested first. As experience with the model grows, larger areas and more comprehensive programs can be undertaken. In short, the model provides the basic guideline, while the development planner provides the final application.

Chapter 1

INTRODUCTION

1.1 Purpose of Report

One of the most difficult problems in development financing is finding good programs and projects to support. Development assistance organizations need well-prepared proposals that address the needs of the country, the objectives of the funding institution, the means by which the activities will be carried out, and the benefits that can be expected. By the time formal proposals reach multilateral and bilateral funding institutions, a considerable amount of time and effort has elapsed. If the proposals do not meet the criteria established by the various institutions and, in particular, if they do not show a high probability of eventual success, the process may have to be repeated at great expense.

Many development assistance organizations have attempted to deal with this problem by developing guidelines for program formulation and by providing their own technical and administrative staffs to assist in the proposal preparation process. Unfortunately, few organizations have sufficient personnel to oversee program proposals from their very earliest stages. As a result, the initial concepts of program formulation are poorly developed in comparison to the later stages of specific project planning and appraisal. The general practice of the development banks, in particular, is to step into this process only after the host country or some other institution has identified a potentially valuable activity. This lack of direct involvement by the funding institutions in the earliest stages of development planning causes initial program formulation to be the weakest link in the overall development process.

USAID, on the other hand, is one of the few organizations to maintain a significant permanent presence in the developing countries. The USAID policy is to conduct local investigations with in-country mission staff, supplemented when necessary by headquarters staff and short-term consultants. Most other development organizations must rely upon headquarters personnel, consultants, or host government officials. By utilizing in-country mission personnel in the project preparation process, however, USAID has the potential for developing a cadre of people more knowledgeable of and sensitive to the needs of the country and the requirements of the Agency. Despite this institutional strength of USAID, a basic problem continues to plague almost all major development organizations: how to identify possible development activities having a high probability of success.

This paper is directed at development planners in general and USAID mission personnel in particular who become involved in the early stages of both broad program formulation and specific project identification. In particular, it is intended to assist them in understanding the social and economic characteristics, or preconditions, that influence the outcomes of programs for the establishment of community water supply and sanitation projects. It is believed that an understanding of preconditions and their relationships to ultimate project success can assist the planner in the very earliest phases of program formulation and subsequent project identification.

The emphasis in this report is on the formulation of water and sanitation programs, which can be defined as a set of related activities occurring over a wide geographical area, such as a region, province, or the entire country. Programs, in turn, consist of a number of site-specific projects. For the purposes of this report, these projects are limited to the development of capital works, such as community water supply systems and household excreta disposal facilities, plus any associated project components, such as community organization, hygiene education, and personnel training. The World Health Organization uses the term "coverage programs" to describe the expansion of water and sanitation facilities and the term "support programs" to describe the development of institutional and personnel resources needed to support these facilities.

Although the emphasis in this report is on program formulation, most earlier investigations into preconditions have generally concentrated on project identification. For this reason, much of the discussion in this report is project oriented. Attempts have been made, however, to point out the distinctions between the two areas, wherever possible.

1.2 Program Development Cycle

Initial program formulation constitutes only a small part of the overall program development process. Program development can be viewed as a continuous cycle of planning, implementation, and evaluation, which in turn, feeds into further planning. By classifying this cycle into its major components, the role of social and economic preconditions can be placed into perspective. Figure 1 illustrates the program development cycle in terms of the following eight phases or steps:

1. Problem recognition
2. Goal formulation
3. Data collection and analysis
4. Generation of alternatives
5. Program appraisal and selection
6. Program implementation
7. Program operation
8. Program evaluation

The first step involves the initial identification and definition of a problem. In the water supply and sanitation sector, this step may be initiated by an assessment of basic needs, by direct requests of affected communities, or by evaluations of earlier projects. Problems are often defined in terms of status indicators, which can be used to show the discrepancies between what out to be and what is. The second step is the formulation of goals, objectives, and targets necessary to eliminate or reduce the problem. These goals and objectives state what will be (or should be) accomplished by the subsequent plan and provide the official justification for a development program. In most cases, goals and objectives should be derived from agency policies, host country statements, and local community desires.

Step three, data collection and analysis, forms the basis for programs designed to eliminate, or at least reduce, the particular problem. This step can be viewed as a process of answering specific questions on current problems, future needs, available resources, and possiblie solu-

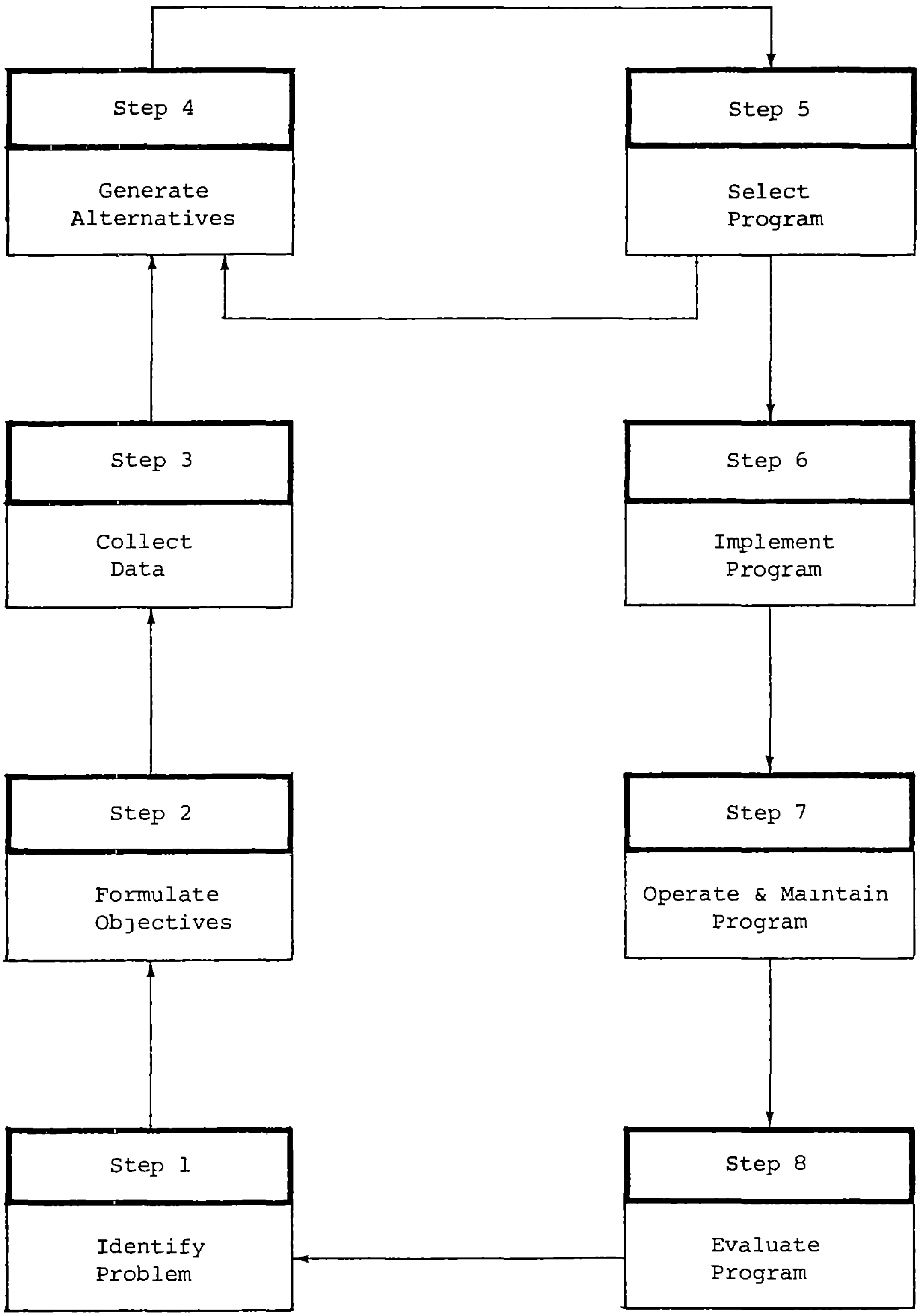

Figure 1

General Planning and Development Model

tions. The key aspects of this process are selecting the right questions to ask and allocating the appropriate level of effort to obtaining the answers. Step four is the generation of program alternatives. Information from all three previous steps should be used to develop a reasonable range of alternative solutions. Some alternatives may require additional data; therefore, an iterative process between steps three and four often occurs. Step five involves an appraisal of alternative solutions and an eventual selection of a program for implementation. Appraisal tests may include analyses of technical, social, political, economic, financial, and institutional feasibility.

Program implementation, the sixth step, is the capital expenditure phase of a program. For water and sanitation programs, this involves the construction of facilities and the procurement of major equipment and supplies. Upon completion of procurement and construction, the long-term operation of projects and systems begins. This is step seven, which is marked primarily by recurrent expenditures. The successful performance of this step of the program development cycle is usually dependent upon the quality of the support services provided to the water and sanitation systems. Finally, step eight is the review and evaluation of the program. A comprehensive evaluation will include an assessment of the operation of the systems, the utilization of system outputs, and the socio-economic impacts of that usage. In the course of this evaluation, program deficiencies may be detected or new problems may be identified, thus initiating a new cycle of problem definition and program planning.

1.3 The Role of Preconditions in Program Development

Since preconditions have been defined as the social and economic characteristics that influence the outcomes of community water supply and sanitation programs, the establishment of successful programs can be greatly assisted by an identification of these preconditions during the initial phases of program planning. The optimal time for the identification and assessment of preconditions is during the program identification phase, and, in particular, immediately after the initial identification of the problem. In Figure 1, this occurs primarily with step 1, Problem Recognition, and becomes a primary input into step 2, Objective Formulation. The identification of preconditions at this early stage helps to answer the first major question in the planning process: Is there a program (or project) which can successfully address the water and sanitation problem identified in step 1?

The overall role of preconditions in program development can be viewed as a series of five sub-assessments starting with the definition of the problem and ending with a determination of the expected program outcomes. As illustrated in Figure 2, the first assessment is the initial identification of a water and sanitation problem. The second and third assessments involve a review of the socio-economic characteristics of the affected community and a preliminary selection of interventions

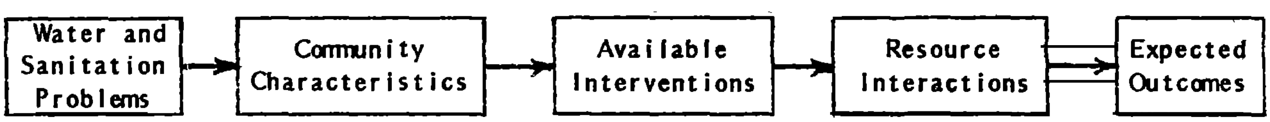

Figure 2. Assessment of Preconditions in Program Development

suitable for these characteristics. Assessment four consists of the interaction between the community, available resources, and the types of intervention chosen. And finally, the fifth assessment comprises the general benefits expected from the overall program. Having made these assessments, the planner should be able to judge whether or not a potentially successful water and sanitation program can be developed.

Thus, the purpose of this report is four-fold: (1) to determine the nature of social and economic preconditions, (2) to review the range of preconditions described in the development literature, (3) to develop a model to aid in understanding preconditions, and (4) to recommend operational guidelines for the identification of preconditions in the field. It is intended that this report provides both a better conceptual understanding of, and a practical planning framework for, the intial stages of community water supply and sanitation program develop ment.

To achieve the above purposes, Chapter 2 of this report includes a review of the literature on impact studies in order to show the range of impacts that are possible from water supply and sanitation interventions and to suggest methods by which impacts can be predicted. Chapter 3 explores various aspects of preconditions, including the socio-economic characteristics of communities, the appropriate levels of technological interventions, and the types of supporting resources need for program implementation. The findings of Chapter 2 and 3 are synthesized in Chapter 4 into an analytical model for the identification and assessment of preconditions. And lastly, Chapter 5 presents some recommended guidelines for the use of preconditions in program formulation and project identification.

Chapter 2

IMPACTS OF COMMUNITY WATER SUPPLY AND SANITATION INTERVENTIONS

2.1 Purpose of Chapter

Water supply and sanitation programs and their associated projects are intended to achieve specific results, which may be called benefits, favorable changes, or impacts. To properly plan such projects, therefore, it is necessary to know the range of possible impacts and to understand the interactions between the interventions and the expected impacts. This chapter comprises a review of the impact assessment literature on water and sanitation projects. The primary purpose of the chapter is to show the range of impacts that can be expected from small-scale water and sanitation interventions in the rural areas of developing countries. A secondary purpose is to show how these impacts can be predicted at the earliest stages of project indentification.

Impact studies are basically tools for measuring results, understanding processes, and predicting outcomes. As a research tool, they are our chief source of information and insight into the development process. As an evaluative tool, they provide crucial guidance on the planning process. In both cases, impact studies are the best source of existing information on program formulation and project identification.

The water and sanitation literature reviewed in this chapter has been selected on the basis of its relevance to impact assessment. The information drawn from these studies is then used to develop a model of impact assessment usable in the project identification process. The literature review begins with the early public health studies, continues with the multidisciplinary field studies of the 1960's and 1970's, and concludes with the current impact assessment policies of the World Bank and USAID. Throughout this period, the complexity of impact interactions and the need for complementary inputs have become increasingly apparent. Attempts to match this growing awareness with more sophisticated field studies has not been entirely successful because of basic problems of research design and field control. The result is that impact studies to date have provided ideas and insights but not proof or certainty.

The general conclusions of the chapter refer to the likelihood of finding specific impacts, the current level of understanding of impact interactions, and the importance of complementary inputs.

2.2 The Nature of Impact Assessment

The general process of project planning and the more specific process of project identification are founded upon the assumption that it is possible to reasonably predict the future consequences of proposed projects. This assumption rests upon an even more fundamental precept: that interventions, such as water supply and sanitation projects, cause a wide variety of physical, behavioral, and other changes in a community. Without this precept, there can be no development, and without the initial assumption, there can be no control of development. In water supply and sanitation, the consequences of projects may include the immediate effect of water flowing out of a pipe for the first time, the somewhat less direct effect of changes in overall community water use, and the very indirect effect of greater community solidarity stemming from local participation in planning and implementation of the system. Depending upon the training, experience, and overall objectives of the planner, the predicted consequences of a project may be either narrowly or broadly defined. Whichever is the case, there must be a way of testing whether the predictions of project consequences are indeed fulfilled for planning to be an effective tool for project development. The assessment of such consequences is the role of impact studies.

Since impact studies involve changes in certain variables over time, more than one set of measurements must be made. This has resulted in a variety of research designs intended to best measure the changes in variables. Essentially, however, most can be classified as one of two types: horizontal studies and longitudinal studies.

In the case of horizontal or cross-sectional, studies, two or more similar study areas (villages, cities, etc.) differing only in the existence of a water supply and sanitation project are compared with each other at the same point in time. The city without the water project is considered to be the "before" case, while the city with the project is the "after" case. The differences in the measured variables between the two cities are attributed to the presence of the water and sanitation project in the second city. Horizontal studies have the advantage of providing impact results almost immediately, without the necessity of waiting for the actual impacts to develop. Unfortunately, the results of these studies are not very valid, since it is almost impossible to find two areas which are (1) similar in all respects save their water and sanitation situations and (2) similar in their responses to the introduction of such a system.

Longitudinal, or time-series, studies offer more validity but also more measurement problems than horizontal studies. In the longitudinal case, a study area is investigated before the introduction of a project and again after completion. Thus, where the horizontal study involves different places at the same point in time, the longitudinal study involves the same place at different points in time. In order to gauge the changes that would have occurred in the study area in the absence of the project, a control area without a project usually is established and investigated at the same times as the study area. The net change attributed to the project is take to be the net change in the study area minus the net change in the control area. Figure 2 is a simplified model of a longitudinal impact study containing both study (experimental) and control groups.

Theoretically, longitudinal studies are an excellent basis for the determination of project-induced studies. Their main drawbacks in comparison to horizontal studies are higher costs, unpredictable future situations, and the difficulties of maintaining research efforts over long periods of time.

The importance of the control group in both horizontal and longitudinal studies cannot be overemphasized. Without a control group, there is no way that non-project induced changes can be measured. The control group essentially transforms a "before-after" situation, which involves two different points in time, to a more accurate "with-without" situation, which involves only a single point in time.

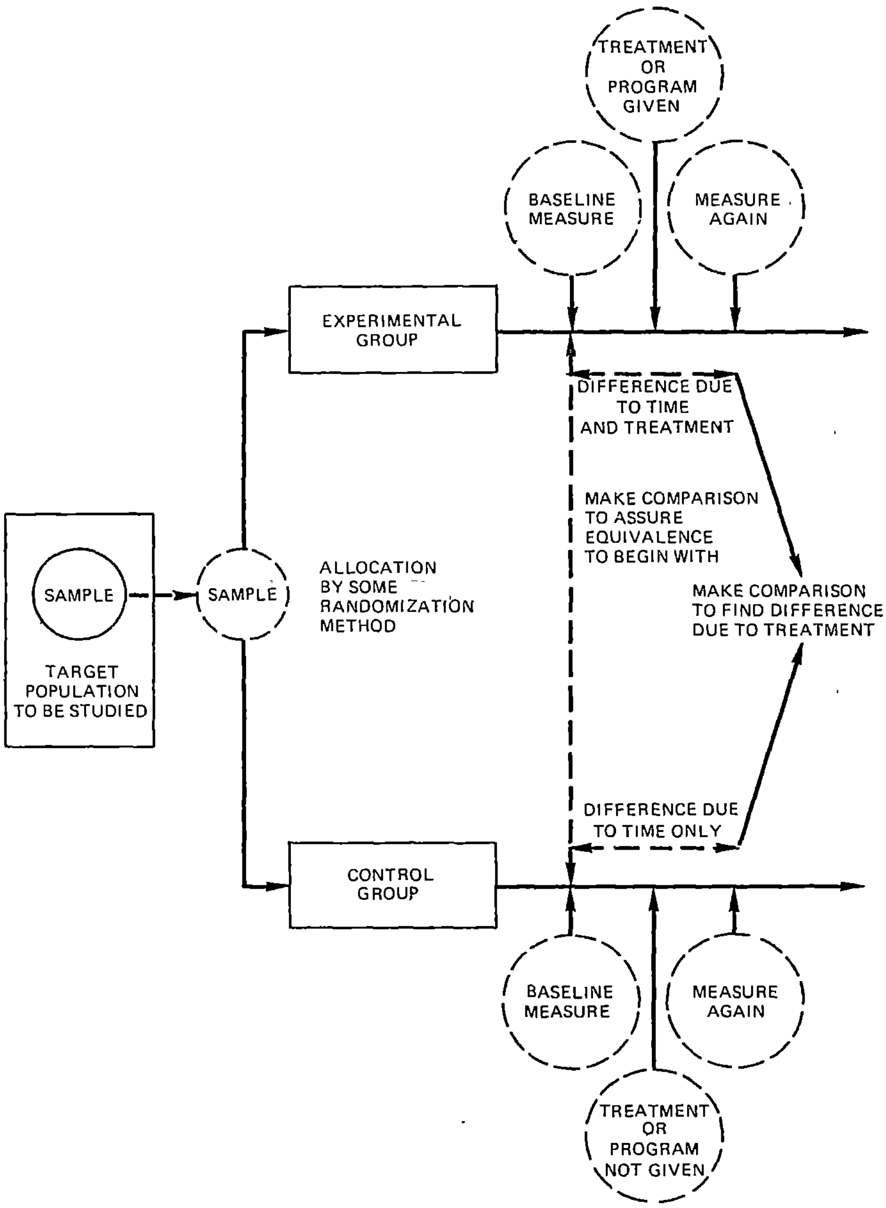

Figure 3. Model of a Longitudinal Impact Study (USAID, 1974).

2.3 Early Studies of Public Health Impacts

Early studies of the impacts of water supply and sanitation projects concentrated almost exclusively upon the public health impacts. Between 1850 and 1950, there evolved a growing understanding of the role of water supply and sanitation in the transmission of infectious disease. A great deal of effort during this period was devoted to finding relationships between improvements in water supplies and subsequent reductions in waterborne disease rates. Initial concern over public health impacts can be traced back to mid-nineteenth century attempts to link the spread of epidemic diseases to the use of polluted water supplies. The classic example of Snow (1855), which showed that water from the Broad Street pump in London was responsible for the spread of cholera, set the pattern for future epidemiological investigations of waterborne disease transmission from a common source.

Classical epidemiological models, which rely heavily on cultural and behavioral information from the affected population, unfortunately, can rarely be applied to rural areas of the developing world. As described by White et al. (1972), the usual common source epidemic arises from pollution of a large water source, such as a municipal water supply. In rural areas, however, the single common source rarely exists and most people draw their water from small, often isolated, supplies. These supplies may be heavily polluted, but the number of users is generally small, and the actual number of cases, which rarely exceeds 30 to 40 percent even in severe common source epidemics, is usually too few to show that water is the infective vehicle. The chances of an epidemic breaking out in a rural area where only a few people use any given water source are less than in an urban area served by a single municipal water supply. Nevertheless, waterborne diseases, such as typhoid and cholera, may be endemic in rural areas because of the large number of relatively isolated water sources through which they may be transmitted. To successfully apply the classical epidemiological model to such conditions requires an intimate knowledge of water uses and the behavioral patterns of the water users. Since such knowledge is rarely available, investigations of this type are not carried out in the rural areas of the Third World.

In urban areas, even slight to moderate pollution of a large common water source may have epidemic consequences. The natural reaction of sanitary engineers to these hazards, therefore, has been to develop high technical standards of water treatment and distribution. Although these standards are not generally applicable to the rural areas of developing countries, they and the systems built to their specifications have been spectacularly effective in reducing the incidence of waterborne infectious diseases in urban areas. Because of the general availability of routine epidemiological data for most urban areas of the developed world, the public health impacts of urban systems have been extensively investigated in a number of wide ranging statistical studies.

According to Wolman and Bosch (1963), typhoid was long suspected of being transmitted by contaminated water. The annual reports of the Massachusetts State Board of Health prior to 1900, for example, show ample evidence of the value of public water supplies in the reduction of typhoid fever even before the use of chlorine was adopted. During the twentieth century, while municipal water supplies were being built throughout the United States, the national death rate due to typhoid decreased from 35.8 per 100,000 in 1900, to 2.5 per 100,000 in 1936, to virtually zero in the 1960's.

By the 1920's, interest in water-related public health impacts had grown to include cholera, typhoid, dysentery, gastroenteritis, and infectious hepatitis. A series of statistical studies of waterborne disease outbreaks covering the period 1920-1970 suggested that better treatment methods and operational controls at water treatment plants were positively associated with reductions in gastrointestinal illness (Warner and Dajani, 1975). Similar results can also be found for municipal water systems in Great Britain.

In summary, early public health investigations generally employed neither horizontal nor longitudinal study designs. The two methods most widely used were classical epidemiological investigations, in which a great deal of information was collected on existing behavioral patterns, and statistical studies, in which existing statistical data was used to identify trends in disease incidence. Although both methods were primarily concerned with the analysis of past situations, they soon led to greater public concern over the prediction of future conditions. The next two sections show the gradual evolution of impact assessment models in water and sanitation over the past thirty years.

2.4 Impact Studies in the United States

Field investigations of the public health impacts of rural water and sanitation systems in the United States began about 1950. Within ten years, the studies had broadened to include the economic impacts of water systems and, by the 1970's, field investigations began looking at a wide range of health, economic, social, and political consequences. During the early years, emphasis was placed upon horizontal (or cross-sectional) studies of public health conditions in comparable areas at a single point in time. The most notable of these studies were by Stewart et al. (1955), Watt et al. (1963), Hollister et al. (1955), and Schliessman et al. (1958), all of whom looked at the relationships between water and sewer facilities and the incidence of diarrheal disease and enteric infections, usually *Shigella* or *Ascaris*. The general conclusion of these studies was that households with indoor water faucets and flush toilets had lower infection rates for diarrhea, *Shigella*, and *Ascaris* than did those with outside (or no) plumbing.

After 1960, there was a discernible shift among health-related studies, to the longitudinal (or time-series) type in an attempt to achieve greater control than that offered by cross-sectional studies. Health conditions were monitored in an area both before and after a programmed improvement of water and sewer facilities. If possible, an unimproved control area also was monitored concurrently. The U.S. Public Health Service (1968), for example, found that the installation of water and sanitary facilities in households in Indian communities in Arizona resulted in significantly lower enteric disease rates than in control households. The report concluded that sanitary facilities had a greater impact through disease containment than through prevention and that proper health education was necessary to maintain the health benefits. In a related study, Rubenstein et al. (1969) found that the installation of indoor water and toilets in a Hopi Indian village in Arizona was associated with a significant reduction of hospital visits for infant diarrhea. A traditional faction in the village refused to cooperate with the project, however, and continued to use outdoor water taps and privies. The average clinic visits for infant diarrhea for this group decline only marginally.

Another line of inquiry, economic impacts, also developed in the 1960's. Pyatt et al. (1962) applied cost-benefit techniques to municipal water supply improvements in Puerto Rico and assumed the health benefits to be a reduction in mortality, morbidity (loss of worker wages), and debilitating disease and chronic suffering (decrease of production). By discounting worker income streams, B/C ratios were calculated which indicated that breakeven points for project profitability were reached ten years after the start of a water program.

More recent, but less rigorous, studies have looked at a broad range of social and economic impacts beyond health and the control of disease. Peterson (1971) found that rural water supply systems had a positive economic impact in certain areas of Mississippi by their encouragement of commercial farming operations and their influence on land values. In addition, the systems encouraged young people to stay in rural areas, caused alterations in water consumption patterns, and strengthened local leadership and local organization. Metcalf and Eddy, Inc. (1972) determined that access to high quality water can have the economic effect of decreasing bottled water purchase, soap and detergent costs, and the frequency of water heater replacement, if the former water source was high in dissolved solids, hardness, and chloride ion concentration.

On the basis of published data and selected interviews, Wills and Osborn (1969) concluded that the installation of water systems in small towns in Illinois resulted in several economic benefits, including increased business activity and employment opportunities, increased farming operations, increased property values, decreased water hauling, and fewer problems with private water systems. Additional benefits included new house construction, general population increases, increased fire protection, increased number of bathrooms, new laundry facilities and car washes, increased convenience, less anxiety regarding the water source, and availability of water for lawns and gardens.

An extensive mail questionnaire survey by Landry (1973) in Mississippi showed that the economic impacts associated with rural community water systems in Mississippi consisted of the injection of construction money into the local economy, the attraction of new industries, increased employment, increased incomes, and the expansion and improvement of existing farms and industries. Futhermore, a list of other development impacts were identified, including increased land use, stabilized populations, increased use of water-using appliances, increased home improvements, better standards of living, increased water consumption, improved roads, and new community pride.

In 1975, Warner and Dajani attempted to identify the full range of potential impacts of rural water and sewer development (Warner and Dajani, 1975). Drawing upon both field investigations and literature surveys, the authors uncovered a total of 124 potential impacts in the areas of initial technical performance, secondary environmental effects, and ultimate human impacts. Each of the impacts was assessed in terms of its time effect, degree of causality, state of knowledge, ease of measurement, and priority of research. The complete list is not shown here, but the impacts fall within the following associated groups:

Performance level

- Water supply impacts
- Fire protection impacts
- Wastewater disposal impacts
- Overall system impacts

Environmental level

- Individual and household impacts
    - Water and sewer availability
    - Water and wastewater fixtures
    - Household water use
    - Wastewater disposal
- Community impacts
    - Community water use
    - Population
    - Community character

Human impact level

- Health impacts
    - Hygiene
    - Nutrition
    - Morbidity
    - Mortality
- Economic impacts
    - Fire protection
    - Property values
    - Cost of government services
    - Government services
    - Corporate profits
    - Personal incomes
- Social impacts
    - Employment opportunities
    - Income distribution
    - Community age structure
    - Availability of community services
    - Utilization of community services
    - Community leadership
    - Community participation
    - Community morale

Although none of the above studies and surveys conclusively demonstrates causal relationships between water and sanitation development on the one hand, and health, social, and economic consequences, on the other, these investigations suggest strong positive links between projects and impacts. The main feature characterizing impact studies in the United States over the quarter century from 1950 to 1975 was the rapid enlargement of the concept of impact. At the start of this period, investigations were concerned primarily with reductions in infectious water-related diseases. Within ten years, interest had grown to include the economic value of improved health, and by the end of the period, studies were attempted to assess a wide-range of social, economic, and community development impacts. The evolution of impact studies in less developed countries has followed a similar course.

2.5 Impact Studies in Less Developed Countries

2.5.1 Early Public Health Studies

Impact studies in the LDC's have paralleled those in the developed world. Starting from a narrowly-focused public health base in the late 1950's, the studies in the Third World rapidly expanded to include broad socio-economic impacts by the early 1970's. The earliest studies, however, were usually cross-sectional investigations into a single health variable.

The first major concern of the international development organizations was the impact of improved water and sanitation on diarrheal diseases. Typical of these were a series of cross-sectional studies sponsored by the World Health Organization in the early 1960's in Mauritania, Sudan, Egypt, Sri Lanka, Iran, East Pakistan, and Venezuela. As summarized in Saunders and Warford (1976), the availability of water in the WHO studies generally did influence diarrheal rates, but the reduction of diarrhea was much greater in areas having good sanitary facilities than in areas with poor sanitation.

Because of the difficulties of experimental control, very few longitudinal (or time-series) studies of the public health impacts of water and sanitation projects have been carried out in developing countries. Among the exceptions are several longitudinal investigations of schistosomiasis, which is a disease transmitted by helminths, or parasitic worms, whose larva first multiply in certain freshwater snails and then emerge to penetrate any nearby human skin surfaces in the water. Starting in the early 1960's studies of schistosomiasis control methods revealed great difficulties in killing either the parasitic helminths or the intermediate host snails but potentially greater success through environmental controls. These include keeping people away from snail invested waters, providing filtered drinking water, and providing sanitary excreta disposal facilities to prevent snail eggs passed by infected people from reaching open water where they begin the schistosome life cycle again (Saunders and Warford, 1976).

In general, the results of the early public health studies, although flawed by weaknesses in experimental design, gave strong indications that improved water supply and sanitation could be used to reduced the levels of infectious disease. This encouraged investigators to look beyond cross-sectional studies of a single health issue to a more complex longitudinal approach involving multiple impacts.

2.5.2 Broad-Based Economic Development Studies

In the mid-1960's, the establishment of rural development programs in the newly independent countries of Africa and Asia led to a growing interest in the overall spectrum of effects arising from development projects. The earlier successes with single-issue, cross-sectional water supply and sanitation studies were seen by policy-makers, planners, and researchers as indications that the multiple impacts of water and sanitation interventions could be clearly identified and evaluated. Broad-based studies were designed which incorporated multi-disciplinary assessments and, often, longitudinal approaches. Initially, there was no comprehensive model of the water supply and sanitation development process, and even today none fully explains the complex interactions between basic interventions and ultimate impacts. Over the past fifteen years, however, great strides have been made in understanding these interactions and in developing procedures for predicting their occurrence.

Some of the earliest field studies of the broad range of rural water supply projects were carried out in East Africa in 1960's. In Kenya, the Zaina area of Nyeri district was closely monitored over the period 1961 to 1970 to determine whether changes in health and economic conditions resulted from the introduction of piped, chlorinated water supplies. Baseline surveys of existing health, housing, and sanitation, and various economic conditions were made of the project area and of a nearby control area in 1961. Following the construction of water lines to farms and villages, plus the installation of showers, washing facilities, and aqua privies and the establishment of a program of health education, the two areas were surveyed again in 1965. The clinical results and survey data showed that, in comparisons to the control area, the project area had unequivocal reductions in _Ascaris_ (common roundworm) and _Taenia Saginata_ (beef tapeworm) plus generally lower rates of overall sickness, gastrointestinal illnesses, and diarrheal disorders, especially among young children (Fenwick, 1965?).

Although the health impacts were apparent, the economic impacts of the Zaina project were inconclusive at best. By 1965, farmers in the project area had expanded their holdings of dairy cattle and their total sales of milk and pigs, but farmers in the control area had concentrated on expanding their cash cropping of coffee and tea. Thus, the two areas were developing along different lines and the influence of water upon economic development was unclear. Unanticipated factors seemed to have positive economic effects in both project and control areas. Water investment alone, however, was not sufficient for automatic increases in agricultural production. A follow-up survey in 1970 also proved inconclusive, causing the authors to state that the mere construction of a water scheme is unlikely to produce the desired economic effects if the "cultural capacity and technical competence of the people are inadequate to utilize water as a production input" (Jakobsen et al., 1971).

The second major impact study in East Africa was a cross-sectional investigation of domestic water use in the countries of Kenya, Tanzania, and Uganda in 1966 by White et al. (1972). It was found that two factors had general significance upon household water use: (1) size and composition of family and (2) level of material wealth. As household size increased, per capita use decreased in both houses with and houses without inside piped connections. However, as the material wealth of connected households increased (measured primarily in terms of decreased density of housing sites and the availability of water heaters), per capita water use increased. For non-connected households, water use was greater in urban sites than in rural sites. Surprisingly, per capita water use in non-connected households was not found to be strongly related to distance from a water tap. Rural households showed little variation in per capita water use for distances up to one mile, beyond which water use decreased. Urban households also showed relatively constant, although higher, water use for distances up to 1500 feet (White et al., 1972).

The White et al. study made its greatest contribution to impact analysis through its investigations of the public health effects of water and sanitation projects. Using questionnaires, excreta and urine specimens, clinical examinations, and existing records, the writers considered the etiology of water-related disease, the relationship between improved water and disease reduction, and the overall social costs of disease in East Africa. Their analysis showed that 11.2 percent of deaths, 11.8 percent of inpatient diagnoses, and 20.9 percent of outpatient diagnoses were from diseases potentially related to water supply. The writers then concluded that approximately 52 percent of current water-related diseases could be abolished through major, although not impossible, improvements in water supplies. A reduction of preventable water-related diseases also could be achieved by direct medical treatment. However, because of high costs and the limited effectiveness of medical treatment in East Africa, the writers concluded that there was "no statisfactory alternative way to achieve the benefits of improved water supplies" (White et al., 1972).

As part of their 1966 study, White et al. developed a classification of water-related infectious diseases that has influenced almost all subsequent studies of public health impacts. Based upon the mode of transmission, the classification has four main categories (White et al., 1972):

I Waterborne diseases - Infections spread through water supply

II Water-washed diseases - Diseases due to insufficient water for personal hygiene

III Water-based diseases - Infections transmitted through an aquatic invertebrate

IV Water-related insect vectors - Infections spread by insects living near water

A fifth category was added later to include infections due to defective sanitation (Bradley, 1977). The classification, along with representative diseases and associated water improvements, is shown in Table 1. Table 2 classifies the more common water-related diseases, shows their relative importance, and indicates the expected reduction in morbidity that could be achieved in East Africa with good water supplies.

Warner (1973) conducted field studies in Tanzania over 1968-1970 in an attempt to measure the impacts generally attributed to improved water supplies. The impacts selected for assessment were derived from national development objectives related to rural water supplies. As shown in Table 3, a total of 30 potential water-related benefits reflecting Tanzanian development objectives in the areas of health, economic productivity, political policy, self-reliance, modernization, and education were initially identified. Longitudinal studies involving household questionnaires, field measurements, field observations, and official records were then carried out on both project and control villages to

Table 1. Classification of Infective Diseases Related to Water Supplies (Bradley, 1977).

Category	Examples	Relevant water improvements
I Water-borne infections		
(a) Classical	Typhoid, cholera	Microbiological sterility
(b) Non-classical	Infective hepatitis	Microbiological improvement
II Water-washed infections		
(a) Skin and eyes	Scabies, trachoma	Greater volume available
(b) Diarrhoeal diseases	Bacillary dysentery	Greater volume available
III Water-based infections		
(a) Penetrating skin	Schistosomiasis	Protection of user
(b) Ingested	Guinea worm	Protection of source
IV Infections with water-related insect vectors		
(a) Biting near water	Sleeping sickness	Water piped from source
(b) Breeding in water	Yellow fever	Water piped to site of use
V Infections primarily of defective sanitation	Hookworm	Sanitary faecal disposal

Table 2. Main Infective Diseases Related to Water Supplies (Bradley, 1977).

Category	Disease	Frequency	Severity	Chronicity	Percentage suggested reduction by water improvements
Ia	Cholera	+	+++		90
Ia	Typhoid	++	+++		80
Ia	Leptospirosis	+	++		80
Ia	Tularaemia	+	++		40?
Ib	Paratyphoid	+	++		40
Ib	Infective hepatitis	++	+++	+	10?
Ib	Some enteroviruses	++	+		10?
Ia, IIb	Bacillary dysentery	++	+++		50
Ia, IIb	Amoebic dysentery	+	++	++	50
Ib, IIb	Gastroenteritis	+++	+++		50
IIa	Skin sepsis and ulcers	+++	+	+	50
IIa	Trachoma	+++	++	++	60
IIa	Conjunctivitis	++	+	+	70
IIa	Scabies	++	+	+	80
IIa	Yaws	+	++	+	70
IIa	Leprosy	++	++	++	50
IIa	Tinea	+	+		50
IIa	Louse-borne fevers		+++		40
IIb	Diarrhoeal diseases	+++	+++		50
IIb	Ascariasis	+++	+	+	40
IIIa	Schistosomiasis	++	++	++	60
IIIb	Guinea worm	++	++	+	100
IVa	Gambian sleeping sickness	+	+++	+	80
IVb	Onchocerciasis	++	++	++	20?
IVb	Yellow fever	+	+++		10?

Table 3. Benefit Hypotheses Drawn from National Development Goals in Tanzania (Warner, 1973)

General form of the hypotheses: The provision of an improved water supply to area results in (... benefit listed below ...)

Health Benefits

1. Increased consumption of water.
2. Higher quality of water.
3. Increased frequency of bathing.
4. Reduced incidence of diarrhea.
5. Construction of better quality houses.
6. Improved medical care.

Productivity Benefits

7. Expansion of water-using industries.
8. Improved livestock condition.
9. Increased economic returns from livestock.
10. Greater efforts on former productive activites.
11. Efforts on new productive activities.
12. Expansion of commercial activities.
13. Increased village gross domestic product.

Ujamaa Socialism Benefits

14. Increased population clustering.
15. Greater sense of socialistic ownership of water supply.
16. Greater commitment to co-operative activities.
17. Greater accessibility to water.
18. Reduced disparities of effort in obtaining water.
19. Greater democratic participation in decision-making.

Self-Reliance Benefits

20. Increased home ownership by heads of families.
21. Increased use of local labor, supervision, and materials.
22. More reliable water supply.
23. Greater local involvement in development projects.
24. Greater local awareness of benefits of cooperative efforts.

Modernization Benefits

25. Greater sense of nationalism.
26. Greater acceptance of technology as a means of improving life.
27. Increased rate of development.

Education Benefits

28. Acquisition of new skills.
29. Improved adult education.
30. Increased school enrollment and attendance.

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assess the impact of water supply projects. The results were assessed in terms of the effects of time, causality, measure validity, and frequency of occurrence. The following group of objectives, which were supported by benefits actually found in the field, was recommended for use in the design of water projects in Tanzania:

1. Increased consumption of water.
2. Higher quality.
3. Greater frequency of bathing.
4. Reduced incidence of diarrhea.
10. Greater efforts on former productive activities.
17. Greater accessibility to water.
18. Reduced disparities of effort in obtaining water.
21. Increased use of local labor, supervision, and materials.
22. More reliable water supply.

Not recommended for use in project design unless new methods of project implementation were developed was a group of objectives which contained basically unproven and high-risk, but important, benefits:

7. Expansion of water using industries.
8. Improved livestock condition.
11. Efforts on new productive activities.
15. Greater sense of socialistic ownership of water supply.
24. Greater local awareness of benefits of cooperative efforts.
28. Acquisition of new skills.

Empirical support for the existence of benefits from the other fifteen objectives was so slight that the writer recommended that they either be given very low priority or be dropped from any further consideration in project design (Warner, 1973).

In 1975-1976, an evaluation of the rural water supply program in Lesotho was made by a team of British researchers (Feacham et al., 1978). The study included cross-sectional comparisons of village water use and detailed investigations of various health, community participation, institutional, political, and economic aspects. Although the relationships of water use to health were emphasized, the study is notable because it gave particular attention to the social, political, and institutional aspects of water supplies.

Surprisingly, very few benefits were detected in the Lesotho program. At the start of the evaluation, potential benefits were identified in the areas of health, economic development, and social development. No measurable reduction in water-related disease, however, could be traced to village water supplies. Nor could any economic "spin offs," such as livestock raising, beer brewing, and communal gardens, be linked to the installation of water systems. The village water projects included in the study did not have a catalyzing effect on the communities in which they were located and they neither led to the development of new leadership nor encouraged population migrations towards improved water supplies. The only measureable benefit found by the researchers was a small amount of time savings resulting from reductions in the water collection journeys. This time was considered to have very little opportunity value for agricultural production because of the constraints of cash, land, and animal traction. Most time savings were absorbed in household and leisure activities. Upon finding so few beneficial impacts, the writers concluded that "too much is expected in the way of benefits from water supplies --- (but that) -- the provision of 200 villages with water supplies is an achievement in itself" (Feacham et al., 1978).

Despite the negative outcome of the Lesotho study regarding water supply benefits, Feacham et al. proposed a useful classification of the immediate aims of community water projects. These aims - high quality, abundant quantity, complete availability, and total reliability - were associated with the subsequent potential benefits of time savings to the households, health improvements, redeployment of labor to productive activities, agricultural improvement, and economic diversification. Table 4 shows the relationships between the immediate aims and the ultimate benefits. The writers recommended that specific goals, or "design benefits," be incorporated into project development. In most cases, they believed that appropriate design benefits would be time savings and health improvements. These aspects were combined into the general proposition that "the design goal of rural water supply improvements should be to reduce the cost of water to the rural poor" (Feacham et al., 1978). Drawing upon the earlier work of White et al. (1972), the writers stated that cost reduction was the sum of:

(1) Cash payments made for water.

(2) Value of time and energy used to collect water.

(3) Cost of sickness related to the use of water.

The determination of these costs, according to Feachem et al., would assist the planner in identifying communities bearing the highest costs for water and communities in which the greatest reduction of costs for a given investment could be achieved.

2.5.3 Research Designs

In the early 1970's, the growing interest in water and sanitation impacts encouraged the formulation of more elaborate assessment models which stressed intermediate linkages, hierachical levels of outcomes, and multidisciplinary benefits. Models tended to become more comprehensive and detailed in setting out a broad range of health, economic, and social impacts. One of the more important developments of this period

Table 4. Relationships Between the Immediate Aims of Water Supply Improvements and Ultimate Benefits (Feacham et al, 1978).

Benefits	*Accessibility*	*Quantity*	*Quality*	*Reliability*
Time-saving	Saving on the water collection journey for each household	–	–	Saving during season when unreliable sources fail
Health improvement	Water piped into homes may increase quantity used (see next column) and reduce exposure to water-based disease	Potential improvement in hygiene if additional water is used	Precludes one avenue of faecal-oral disease transmission	May avoid seasonal use of more polluted sources of water
Labour	Labour released by time-saving, and indirectly by health improvement	Indirect through health improvement	Indirect through health improvement	Seasonal time-saving
Agricultural advance	Possible indirect benefit from labour release	Surplus or waste available for gardening	–	Seasonally significant in some cases
Economic diversity	A prerequisite, but not usually a major one	A prerequisite, but not usually a major one	–	Permits permanent settlement

was the concept of hierachical levels of impact, whereby several sequential stages of outcomes had to occur before the ultimate impacts were achieved. In other words, water and sanitation interventions resulted in direct impacts which then were used to produce additional less direct impacts, and so on until the ultimate desired impacts were reached. Although never fully implemented in the field, these newer models nevertheless provided greater insight into some of the unresolved issues of levels of impact that had been associated with earlier field studies.

Carruthers (1973) was the first to suggest a hierarchical ordering of impacts. In assessing the impact of investment in community water supplies in Kenya, he stated that the anticipated benefits of water supply investments were higher cash income, increased subsistence, improved health, and increased leisure. However, the components contributing to these benefits were difficult to identify because of problems of isolating the effects of water projects and of evaluating the non-market benefits. Carruthers proposed a model in which the primary effects, or direct benefits, of water improvements led to "first order benefits," which in turn generated "second order benefits." The sum of the second order benefits constituted the ultimate outcomes of better incomes, subsistence, health, and leisure. Figure 4 illustrates schematically the major sources from which project benefits may arise.

In the Carruthers model, the immediate direct benefits were given as reductions in time and energy used in water collection, increased water consumption, and improved water quality and supply reliability. These initial benefits, when associated with certain conditions, generated first order benefits, i.e., time savings led to released

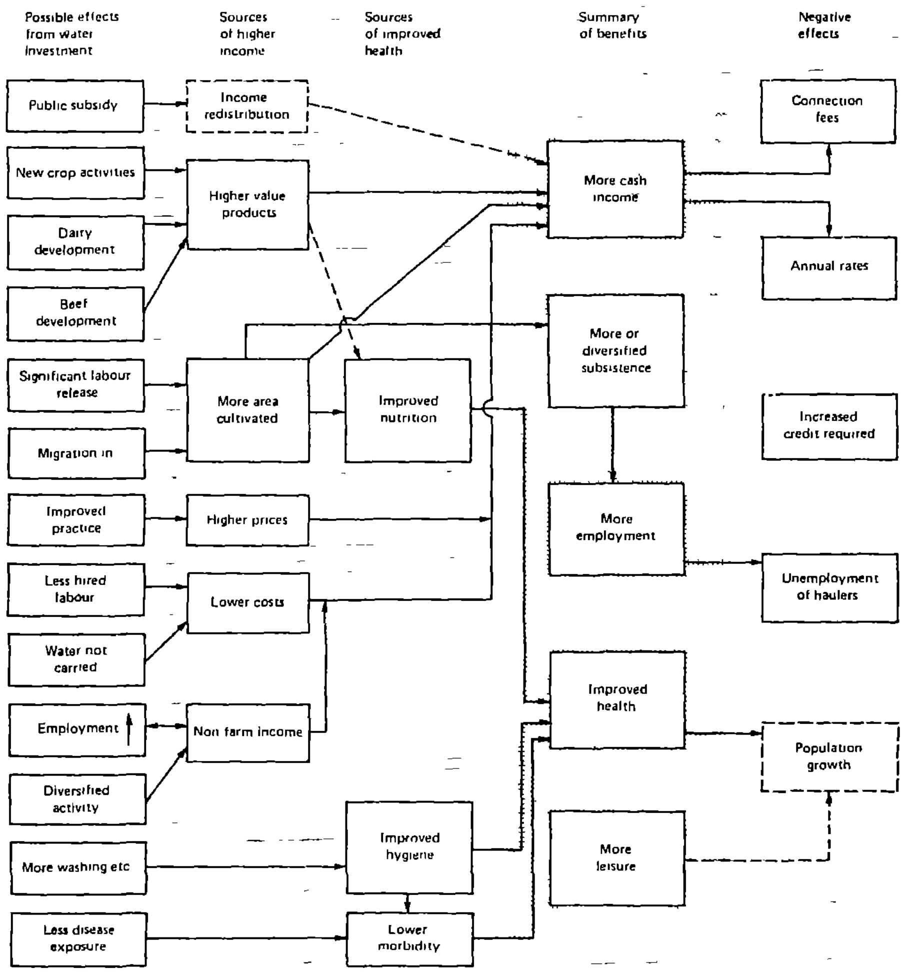

Figure 4. Impacts of Water Investments (Carruthers, 1973).

labor, energy savings resulted in improved labor quality, water quality and quantity improvements affected hygiene and health, and improved system reliability reduced the risks of supply failure. The associated conditions for first order benefits were stated as, first, consumers had to switch from traditional to new sources of supply and, second, they had to use sufficient quantities of water if health benefits were to occur. In a similar manner, first order benefits were a precondition for and led to second order benefits, but again only when certain conditions were met. The second order benefits were seen by Carruthers to include a variety of agricultural improvements, as well as more leisure, lower health costs, increased sense of well-being, and improved family planning. The necessary dependent conditions included the actual use of released labor and land resources, the provision of technical information and health, home economics, and family welfare advice, the availability of complementary resources such as farm credit, and the installation of complementary sanitary facilities.

The importance of Carruthers' work is that it showed that impacts occur in a sequential, or linked, manner and that each step in the process is a precondition for the next step. In addition, he pointed out that impacts at any step will be fully realized only when the specific conditions necessary for that step are present. Moreover, certain complementary inputs may be required for the development of impacts at a given step. These inputs may be directly related to the water project, such as the installation of sanitary facilities, or they may be seemingly unrelated, such as the availability of farm credit. Although Carruthers' model was not made operational, the concepts suggested in it marked the start of the integrated, or systems, approach to impact assessment and encouraged a more holistic view of the project development process.

During this period, the World Bank began looking at health-related projects and wanted to apply the same degree of analytical rigor to them that had been successfully developed for economic projects. In response to a request for methods of measuring the health benefits of investments in water supplies, Bradley (1974) suggested the use of disease indices which had the characteristics of visibility, high prevalence, strong dependence on water supply, and high correlation with other water-related diseases. Although many diseases can be linked to water supplies, the most useful health conditions for the establishment of indices, according to Bradley, were skin diseases, diarrhea, parasitic helminth eggs, eye diseases, and child growth records. His recommendations were that a combination of clinical and laboratory examinations, questionnaires, and field measurements could be used to formulate relevant health indices and that health studies using these indices would have both local and general value for water project development.

The above-mentioned study by Bradley also was intended to provide guidance to a cooperative USAID-World Bank study of the health and nutrition benefits of water supplies in Minas Gerais State in Brazil (USAID, 1975). Problems of funding and research design, however, caused a cancellation of the study before the field work could begin.

At about the same time, Warner (1975) developed for USAID an impact assessment model for urban water systems which incorporated a hierarchical ordering of a multidisciplinary range of impacts. The model did not address the issue of complementary inputs, but it was one of the first to attempt to provide operational guidelines for a broad range of benefits within the context of differing, yet linked, levels of impact. As shown in Table 5, the model proposed sequential stages of measurement involving an initial performance level, an intermediate environmental sanitation level, and an ultimate health, economic, and social impact level. Because of the sequential nature of the impacts, each subsequent level was dependent upon the occurrence of impacts in the previous level. The recommended study was to be longitudinal in nature, extend over a period of four or five years, and take place in five cities.

Warner also proposed an alternative methodology for assessing economic impacts in monetary terms. Since all significant economic impacts of municipal water systems were assumed to be direct in nature (production foregone elsewhere, secondary and external effects arising from the investments, etc.), the economic benefits of urban water investment were equal to (1) the recurrent social costs of the former water systems being replaced plus (2) the net social costs of activities related to the use of water. It was suggested that the total economic impact could be determined by the sum of the following monetary measures:

(1) Recurrent social costs of the former water systems

Measure: economic costs incurred by the community in using the former water systems

(2) Net social costs of activities related to the use of water

Measures: (a) morbidity - loss of current work income and costs of associated medical care

(b) mortality - loss of current and future work income and costs of associated medical care

(c) fire protection - fire losses or fire insurance rates

Table 5. Measures of Urban Water Supply Impacts in the Philippines (Warner, 1975).

I. Performance Measures

1. Service (service area, connections, system reliability)
2. Water delivery (population served, quantities delivered, consumption per capita)
3. Water quality (bacteriological characteristics, chemical characteristics)
4. Fire Protection (hydraulic capacity, storage capacity)

II. Environmental Sanitation Measures

1. Water availability (water sources, water delivery)
2. Water-related facilities (storage, water-use facilities, wastewater disposal facilities)
3. Water use (domestic, commercial and industrial, agricultural)
4. Waste water disposal (domestic, commercial and industrial, agricultural)

III. Final Impact Measures

A. Health Measures

1. Mortality (infants, pre-school children)
2. Nutrition (infants, pre-school children)
3. Morbidity (infants, pre-school children, pregnant or nursing women, women in charge of children)
4. Hygiene (toilet practices, bathing practices, infant feeding practices, kitchen cleanliness, bacterial density)

B. Economic Measures

1. Personal income (personal income, home improvement investments, utility and service expenditures, home businesses)
2. Corporate income (commercial, industrial, government, institutional establishments)
3. Fire Protection (fire insurance premiums, fire hazards)
4. Project-related employment (project employment, displaced employment, induced employment)

C. Social Measures

1. Attitudes (health, employment, local community)
2. Education (school enrollment and attendance, material literacy, adult education, job training)
3. Mobility (social and political, economic, locational)
4. Social Services (available facilities, distribution of facilities)

(d) project-related personal income - changes in employment income related to water

(e) project-related corporate profits - corporate profits resulting from new goods and services to the new water system

Assessment models such as the above provide a more holistic picture of the overall interactions resulting from water and sanitation projects. Unfortunatley, they require a great deal of data collection in the field and, consequently, are quite costly. Despite this drawback the above model developed by Warner was used by USAID with some modifications to evaluate the Provincial Cities Water Supply project in the Philippines.

2.5.4 Bibliographic Studies

In the mid-1970's, a number of annotated bibliographies were produced on the health, technology, and impact relationships of water supply and sanitation in developing countries. White and Seviour (1974) prepared a bibliography of 237 items which provided a general overview of rural water supply development but only minor information on sanitation works. A closer examination of the health and economic impacts of water supplies was made by Saunders and Warford (1974) as part of the growing concern of the World Bank towards rural water development. They generally agreed that the following consequences could arise from improved supplies:

Economic effects:

(1) General growth and redistributive effects on the national economy.
(2) Possible short and long-run direct effects (gardening, animal husbandry, property values, commerce, and village industry).
(3) Effects on labor inputs and earnings (death, morbidity, external health effects, additional time for productive work).

(4) Problems of population size and income.
(5) Possibilities of current cost aversions.
(6) Influence on population location and stability.

Health effects:

(1) Reductions in diarrhea, skin diseases, cholera, typhoid, and schistosomiasis.
(2) Reductions in overall child mortality.

Saunders and Warford concluded that the literature was of little help in quantifying the relationships between water and sanitation improvements and health. They found that predicting the impacts of water and sanitation programs, whether in terms of health, income redistribution, productivity, or population location, was an "immense problem." As a result, they retreated from the issue of predicting project benefits and, instead, recommended that project worth generally be determined by the willingness of the users to pay for the service (Saunders and Warford, 1976).

The third major bibliographic study was sponsored by the World Bank and USAID in preparation for a comprehensive evaluation of the Minas Gerais water supply project in Brazil (Wall and Keeve, 1974). The bibliographic study was intended to answer three fundamental questions raised during the appraisal of the proposed evaluation project:

(1) What are the nature and magnitude of water supply benefits?

(2) Under what conditions are benefits realized?

(3) What indicators could be used to select and design projects?

Wall and Keeve reviewed 252 documents dealing with the interrelationships of water supply, diarrhea, and nutrition. They admitted that the main nonfinancial justification usually offered for investments in water supply projects was the expected health benefits. The literature provided ample evidence for the belief that an improved quality and increased quantity of water were expected to affect favorably the incidence of mortality and morbidity of over 30 diseases. However, except for diarrheal and skin diseases, few epidemiological studies had explicitly considered the role of water supply. The writers concluded that the available studies did not provide a basis for estimating the incremental health benefits that could be expected from incremental investments in water supply systems. Furthermore, they could find no indication of what pre-existing conditions or complementary changes, if any, were needed to realize the expected health benefits. Rational investment decisions, they stated, required more information about the effect of water project design on health and about the social, cultural, economic, and educational environment for which the projects were designed (Wall and Keeve, 1974).

The fourth major bibliographic study, which was undertaken by the International Development Research Centre (Canada) and the World Bank, surveyed alternative methods of sanitation and human wastes management (Rybczynski et al., 1978). A total of 531 documents were abstracted. Emphasis was placed on the technological issues of design and operation, but consideration was also given to the institutional, behavioral, and health related aspects affecting the choice of appropriate technologies. The study did not detail the impacts of sanitation systems. Instead, it stressed the importance of adapting alternative technologies to the conditions found in the Third world and rejecting the tendency to adopt "universal solutions," especially sewerage systems, from the developed countries.

2.5.5 USAID "Bennett Evaluations"

In 1978, USAID began to appraise the impact of its development projects in several sectors, including the rural water supply sector. This work was given impetus by an October 1979 directive by the then-USAID Administrator, Douglas Bennett, for an agency-wide series of impact evaluations to assess the effects of USAID programs and to guide future development polices. The nature of the studies, which came be to be called "Bennett evaluations," precluded rigorous assessments of specific projects or programs. These studies were retrospective in design; they only viewed a single point in time (the present); they rarely contained any control communities for comparison purposes, and they were based upon relatively short (one to two months) data collecting periods in the field. Moreover, the study designs were not based upon any discernible evaluation models and contained no firm criteria for program success or failure. As a result of these weaknesses, the evaluation reports on water and sanitation projects contained, in some cases, findings which are difficult to interpret and conclusions and recommendations which are highly subjective. These studies, therefore, are not in the mainstream of impact evaluation nor do they contribute to a general understanding of impact assessment. Being basically impressionistic in nature, the observations and findings in these studies should be viewed as potential ideas for further investigation, but not as products of a rigorous evaluation process. Nevertheless, the Bennett evaluations of USAID water supply programs provide many useful ideas regarding social and economic preconditions for successful projects. The following review of several of the studies is intended to highlight some of these ideas.

An evaluation of the Thailand Potable Water Project, which was implemented with USAID assistance between 1966 and 1972, showed that a successful program of construction, institutional development, and community support had occurred (Dworkin and Pillsbury, 1980). The allocation of projects to villages and rural market towns was generally based upon the following criteria:

(1) Community has an existing but not potable source of water.
(2) Community is readily accessible by road.
(3) Villagers are willing to assist in construction.
(4) Community is willing to develop self-sustaining rate structure.

According to the writers, most systems at the time of the investigation were operating reliably and were providing chlorinated water. Improved health was an original objective of the program, but no statistical data existed to confirm such results. Improved sanitation practices and the acceptance of water seal privies, however, were claimed to be associated with the availability of piped water. The greatest impact of the program in the eyes of the local users was its economic benefits, which were not anticipated during the initial period of implementation. Villagers claimed that the availability of piped water resulted in more gardening and farming, more craft activities, and more animal raising.

In general, Dworkin and Pillsbury found that successful village water systems in Thailand were characterized by the following non-technical factors:

(1) Initial community contribution of time, labor, and funds.
(2) Training and subsequent support for local operators responsible for maintenance.
(3) Gradual evolution of viable rate structures for delivery of piped water to individual households.

Furthermore, the writers identified the specific sources of program success as follows:

(1) Thai sanitation personnel which were trained in U.S. institutions constituted a highly motivated, well-trained professional cadre in the program.
(2) Communities which contributed substantial amounts of money and labor generally had successful water systems.
(3) Decentralized support systems were crucial in maintaining high standards of operation and maintenance.
(4) The relatively complex system technology succeeded because the users regarded it as an improvement over the previous technology.
(5) Community innovativeness and motivation were crucial in offsetting weaknesses in project design.

A related evaluation of the national rural water supply program in Kenya revealed a network of large, complex piped systems that were not working well (Dworkin, 1980). The writer found that most systems were unable to provide a reliable supply of water. Moreover, many systems, especially those using diesel driven pumps, were no longer operational because of problems of design, construction, operation, or maintenance. The author could find few benefits accruing to project communities. The communities had not been consulted during the planning and design phases of the project, and an emphasis on metered connections often resulted in service only to a small number of elite users. Dworkin concluded that the level of technology utilized in the program was beyond the capability of the local institutions to support it. Therefore, either institutions needed to be strengthened to carry out the desired level of technology or new systems had to be adopted which could be supported by existing institutions.

A "Bennett evaluation" was also made of CARE water projects in Tunesia (Bigelow and Chiles, 1980). These projects involved the renovation and protection of 300 existing wells and springs with relatively low cost methods of technology. The writers found that the projects did not provide consistently potable water and therefore, health benefits were minimal. In general, water use patterns were not altered by the projects, which were "prepackaged" by CARE without the inclusion of local participation in the design and implementation of the water improvements. Moreover, mobile maintenance teams were ineffective because of inadequate supervision of poorly motivated personnel. Health education personnel also had great difficulty in sustaining a program in the field. The writers concluded that future support should be for:

(1) Goals of increased water quantity, dependability, and accessibility.
(2) Water potability determined in relative, not absolute, terms.
(3) Water projects incorporating community need, social surveys at each site, and acceptance of maintenance responsibility by project users.

And lastly, the Bennett series included a reassessment by Dworkin and Dworkin (1980) of the water supply and diarrhea data in the Food Wastage/Sanitation Cost-Benefit Methodology Project, which was carried out in Guatemala from 1973 to 1976 by the University of North Carolina (1978). The original investigators stated that the study "did not demonstrate that a safe and reliable water supply leads to a decrease in diarrheal morbidity" (Shiffman et al., 1978). Using the same data but differing statistical assumptions and techniques, Dworkin and Dworkin came to the opposite conclusion that "water alone was a sufficient condition to result in decreased diarrheal rates" (Dworkin and Dworkin, 1980). An expert panel convened by USAID to review the issue found that the study suffered from two fundamental methodological defects. The first was that the basis of the study was a comparison of only two villages and that significant socioeconomic and ethnic differences existed between the villages. The second was that the period of observation of the study was too short for long-term impacts of water supply and sanitation to occur, the panel recommended that data from the study "not be used to compare and/or assess the impact of water supply and sanitation on health." Furthermore, they urged that the final report by UNC be revised to indicate "that no valid conclusions to this effect can be derived from the results of this study because of its shortcoming" (WASH, 1981).

Ignoring the merits of the contradictory conclusions reached by the original investigators and the subsequent evaluators, the Guatemala study and its aftermath provide a good illustration of the difficulties inherent in the assessment of impacts of water and sanitation projects. There still is much to be learned about the identification, prediction, and measurement of impacts. The not infrequent controversies that arise over assessment procedures and results from field investigations should be a warning sign to the development planner who wishes to use impact assessment concepts as part of the project identification process. A great deal has been learned in recent years about the interactions leading to ultimate project impacts. The remaining areas of uncertainty are so numerous, however, that while impact prediction may be essential for project identification it continues to be a process highly dependent upon individual experience and judgement.

2.5.6 Summary of Impacts

As described in previous sections, investigations into the impacts of water supply and sanitation interventions arose initially from a desire to reduce the incidence and severity of water-related gastrointestinal infections. This led, in time, to studies of the economic value of improved health in terms of reductions in costs of medical care and increases in worker productivity. Eventually, impact investigations broadened still further to include a wide range of social, economic and community development benefits.

One of the crucial issues highlighted by the early impact studies was the complex nature of linkages between water and sanitation facilities and their ultimate benefits. The failure of many impact investigations to find anticipated benefits was probably due to a lack of understanding of these linkages and the conditions necessary for their operation. More recent studies have stressed the sequential nature of linkages leading to progressively higher orders of benefits in models of impact assessment. In general, the literature now refers to the following levels of impact:

1. Initial stage, involving improvements in the resource base, such as water supply quantity and quality improvements, as well as greater accessibility to and reliability of facilities.

2. Intermediate stage, involving the degree of usage of the facilities. This results in immediate benefits, usually time and energy savings and improved hygienic practices.

3. Ultimate stage, involving the long-term, desired benefits of improved health, reduced health costs, greater agricultural output, improved social well-being, and improved environmental quality.

Thus, current models of impact assessment often distinguish between the sequential changes that occur in physical facilities, behavioral patterns, and, finally, ultimate impacts. These changes and the linkages between them are summarized in the revised impact assessment model, shown in Figure 5, which classifies system outcomes into operation, performance, and ultimate impact levels.

As shown in Figure 5, system operation is the immediate, or direct, consequence of project development. This is an efficiency level, in which almost all of the project inputs and system outcomes are under the control of the engineer. His immediate concerns are for the physical status and functioning of the water and sanitation facilities, which can be assessed in terms of accessibility, quantity, quality, and reliability. These factors can be assessed in straight-forward physical units.

System performance, however, is the more complex consequence of the use of facilities. This is an effectiveness level, in which the use of the system by the community determines its continuing success. The project planner is directly concerned with system performance, but while he can control the technical inputs coming from system operation (efficiency level) he cannot fully control the actual use of the system by the community (effectiveness level). To achieve a high level of use of the water and sanitation facilities, health education inputs are probably needed to instill new knowledge, attitudes, and practices (KAP) in the community in order to bring about proper use of the facilities by individuals and adequate support of the system by community institutions.

Performance outcomes are the immediate benefits of the project. They include both behavioral and institutional changes. The former may consist of changes in water use, consumption rates, and sanitation practices, while the latter may include changes in local committees, support organizations, and local maintenance procedures. The important aspect is that the construction of water and sanitation facilities is not sufficient by itself to produce system performance benefits. There

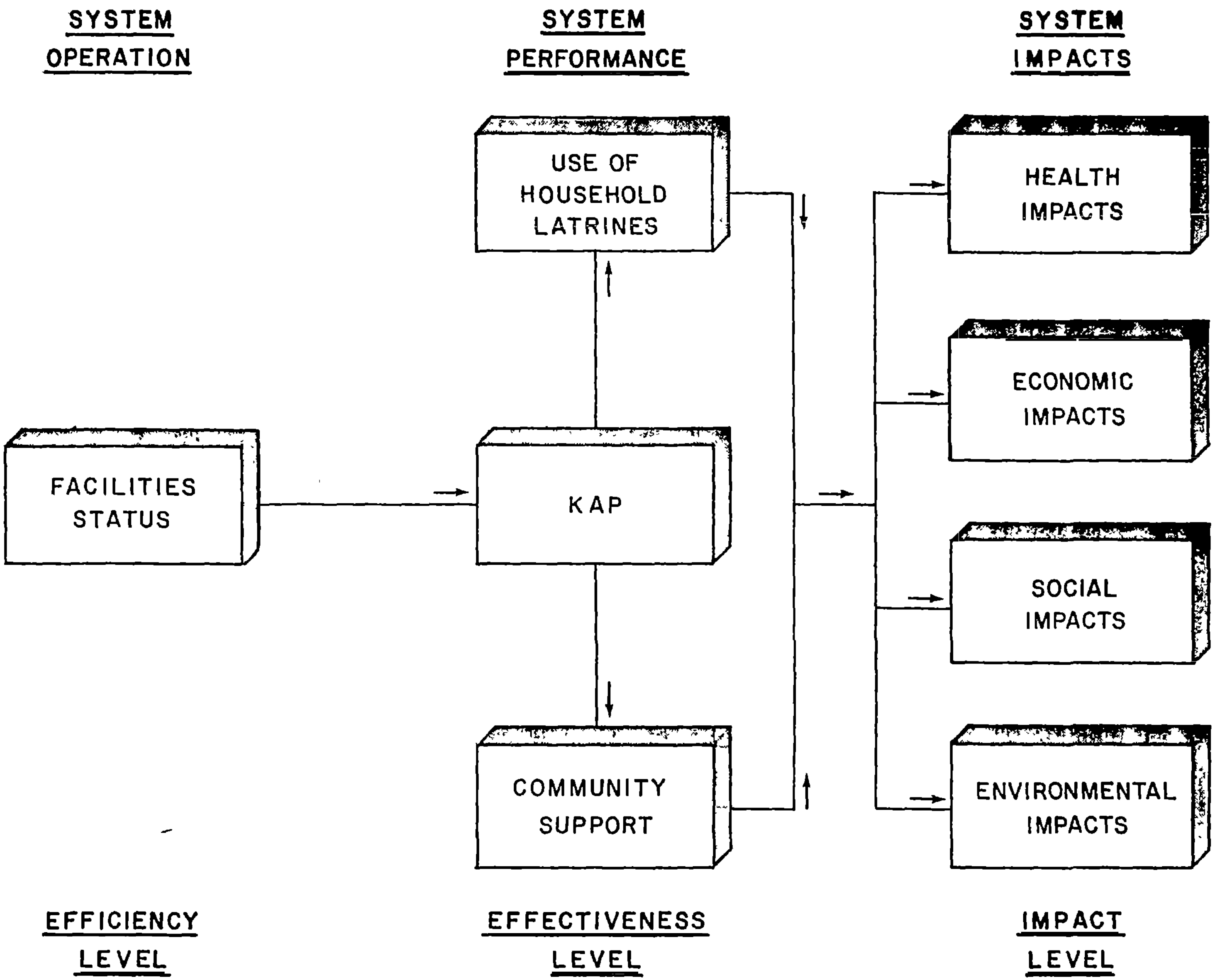

Figure 5. Assessment Model for Water and Sanitation Impacts.

must also be health education inputs plus actual usage of the facilities plus a community response to the need for system support. If any of these inputs are missing, the linkages to the final impact stage will probably fail to materialize.

System impacts represent the ultimate consequences of project development. To the policy-maker, these are the long-term benefits that water and sanitation projects are intended to achieve. They can be classified into health, economic, social well-being, and environmental quality benefits. The essential characteristic of these impacts, is that they are dependent upon behavioral and institutional changes occurring at the performance level. Under optimal conditions, long-term benefits may arise directly out of performance impacts without the need for additional inputs or assistance. In most cases, however, there will be need for a variety of complementary inputs to allow the effects of the water and sanitation intervention to reach the ultimate impact stage. Many of these complementary inputs will involve activities only indirectly related to the water and sanitation project, as in the case of road improvements, the construction of a health center, or the provision of farm credit. The role of complementary inputs is discussed in greater detail in Section 3.7.

As mentioned above, system impacts are the true benefits of water and sanitation interventions. In the health sphere, these may include reductions in fecal-oral diseases (cholera, typhoid, ascaris, ankylostomiasis, schistosomiasis, and various gastrointestinal disturbances), mosquitoe-borne diseases (malaria, filariasis), and skin infections (tinea, scabies, onchercerciasis). Economic impacts include decreased water costs, reductions in medical expenditures, and increased agricultural productivity. Social well-being impacts include greater convenience, improved social status, increased community involvement, and strengthened community institutions. And finally, environmental quality impacts may consist of improved surface drainage, higher quality groundwater, and decreased rodent and insect populations.

2.6 Current Institutional Policies Towards Impact Assessment

As the literature survey showed, the major lending and development assistance institutions gave increasing attention during the 1960's and early 1970's to the identification and measurement of impacts arising from water supply and sanitation programs. By the mid-1970's, however, the earlier optimism over the eventual success of impact investigations began to be replaced by widespread pessimism with impact studies as an effective tool for program planning. Critics of broad impact assessment efforts pointed to the fact that specific studies, as well as intensive literature reviews, had been unable to unravel the complex interrelationships between water and sanitation inputs and the hoped-for ultimate health, economic, and social outputs.

Health impacts, in particular, bore the brunt of this criticism. Since no empirical studies had shown conclusively that health benefits were linked directly and unequivocally to water and sanitation improvements, benefit-oriented impact studies were seen to be a costly and unproductive avenue of inquiry. The development of new program planning methods, therefore, shifted from an emphasis on project outputs, or benefits, to one on project inputs. Attention was increasingly given to simpler financial or market indicators, such as willingness to pay for service, or to other input conditions, such as technological choices, service levels, and institutional capacity.

The reversal in interest was particularly evident at the World Bank. Rural water and sanitation development began to be a major concern to the Bank in the early-1970's. Coupled with this interest was a desire to use the results of impact investigations to guide program design. However, reviews of previous studies were inconclusive at best (Saunders and Warford, 1974; Wall and Keeve, 1974) and attempts to set up new investigations met with growing doubts within the Bank as to the efficacy of such studies. In 1974, a major longitudinal study of the interrelationships of water supply, sanitation, health education, nutrition, and health in Minas Gerais State in Brazil was jointly considered by the Bank and USAID but was shelved in early 1975. An expert panel put an end to further "attempts to isolate specific causal water supply-health relationships" within the Bank by concluding in mid-1975 that such studies were unwarranted because of high costs, inadequate knowledge, and poor results (World Bank, 1976). To date, the Bank has remained aloof from general impact investigations, although it occasionally supports exploratory efforts in the areas of technical and social inputs and health outputs. The current attitude of the Bank towards impact assessment can be st1ted as follows: "The measurement of (health) benefits is not the primary objective of improved sanitation -- achieving them is" (Kalbermatten et al., 1980b).

USAID, which has had a longer experience with community water and sanitation development and the evaluation of these programs, has remained interested in impact investigations and in adopting impact assessment techniques into the project development process. Although the Minas Gerais impact study was dropped, a longitudinal study of water, sanitation, and nutrition was supported in Guatemala over 1973 to 1976 (USAID, 1975). The on-going series of "Bennett evaluations" while not rigorous from a research standpoint, are an indication of current concern for project benefits and goal achievement. Futhermore, USAID is currently considering the establishment of a long-term monitoring and evaluation study of the environmental and health impacts of water supply, excreta disposal, and health education interventions in rural communities in the Dominican Republic (Howard and Struba, 198). In general, USAID in recent years has continually up-dated its formal assessment procedures for environmental impacts, social soundness, and economic appraisal in an attempt to incorporate available knowledge about likely project impacts into the design process (USAID, 1974; USAID, 1981).

2.7 Conclusions from the Literature on Impact Studies

Impact studies of water and sanitation projects can be traced back, in one form or another, for over one hundred years. Studies conducted in developing countries, however, go back only 25 years, and the bulk of current knowledge regarding impact assessment of water and sanitation interventions has come from an even shorter period. In general, impact assessment is carried out for one or more of the following reasons:

1. To evaluate a project.

2. To understand the interactions between initial intervention and ultimate impacts.

3. To develop methods of predicting impacts.

4. To influence policy regarding future programs.

For purposes of program formulation and project indentification, an ability to understand the interactions and predict the resulting impacts is needed.

This review of the literature on impact studies does not fully meet the above purposes. The complexity of impact interactions has, so far, evaded theoretical understanding and has provided almost insurmountable problems to empirical field studies. What has emerged is a slow but progressive understanding of the process of impact linkages and how they are affected by external conditions as well as by the assessment design itself. Impact studies, unfortunately, are the best means of fostering this understanding and the source of major frustrations regarding field results.

The first conclusion is that no impacts are universally found in all studies. Some examples:

- White et al. (1972) in East Africa and Feacham et al. (1978) in Lesotho found no correlation between water consumption and distance for water carrying journeys under one mile. Warner (1973) found that water consumption in Tanzania generally was progressively higher as distances decreased.

- Carruthers (1973) in Kenya and Feacham et al. (1978) in Lesotho stated that improved water supplies did not lead to economic development. On the other hand, the opposite conclusion was reached by Peterson (1971) and Wills and Osborn (1979) for studies conducted in the United States.

- Feacham et al. (1978) in Lesotho were unable to detect any health benefits associated with improved water supplies. In contrast, the early studies in the United States by Stewart et al. (1955), Watt et al. (1963), and others strongly supported the effectiveness of improved water and sanitation facilities in reducing diarrhea.

The explanation for these seemingly contradictory results lies in the fact that few impact studies are directly comparable. Because of dissimilarities or even weaknesses in basic design, poor field procedures, and inadequate control over external events, field studies have always been flawed and should be viewed in the context of the specific study and site conditions in which they were carried out. In this regard, they should be used more as sources of ideas for future work than as definitive proofs of research hypotheses.

The second conclusion is that impact interactions are sufficiently well understood to allow the development of preliminary planning models, although the prediction of ultimate impacts is still an uncertain art. For purposes of project identification, Figure 5 presented a three-stage impact assessment model consisting of an initial technical level of system operation, an intermediate behavioral level of system performance, and an ultimate impact level of long-term system benefits. As described in Section 2.5.6, the linkages between the initial technical inputs and the ultimate system impacts become progressively more complex as one attempts to trace the sequential pattern of project consequences. At each higher level, additional constraints come into play, thereby creating a need for additional complementary investments to ensure the desired outcomes. It is believed that this model or something similar can be used by the planner at an early stage to predict possible benefits of potential programs and projects.

The third conclusion drawn from the review of the literature on impact assessment is that the provision of water or sanitation facilities alone is not sufficient to produce significant benefits. According to Carruthers (1977):

> Empirical evidence shows that an improved water supply, though perhaps necessary for improved health, welfare and economic progress, is not by itself sufficient. Hence the most important criterion for schemes which are designed to assist development is the presence of complementary inputs.

Although the concept of complementary inputs may be acceptable in theory, there is little agreement as to what constitutes a core package of such inputs in practice. As reported earlier, Wall and Keeve (1974) were unable to find any indication in the literature of the type of pre-existing conditions or complementary changes needed to realize the expected health benefits of water supply projects. Given this lack of concensus regarding the actual use of preconditions in project planning, the next chapter will look at project identification guidelines employed by the major development institutions and at related concepts contained in the recent literature.

Chapter 3

LITERATURE REVIEW OF PRECONDITIONS FOR SUCCESSFUL PROGRAMS

3.1 Purpose of Chapter

Over the past ten years, an increasing amount of attention has been given to the conditions and factors crucial to the planning of successful water and sanitation programs. There is a growing awareness in the literature of the signifance of development constraints and the corresponding planning inputs appropriate to these constraints. This chapter reviews the literature from the standpoint of the nature, range, and measurement of the various preconditions which influence the success of water and sanitation programs and projects.

The first part of the chapter defines the general concept of preconditions as used in this report and describes some of the preconditions either being used or actively considered by the World Bank, the World Health Organization, and USAID. The second part of the chapter constitutes a review of the mechanisms of techniques by which preconditions could be assessed. among the methods with the most potential are indicator variables, indices, checklists, and social soundness analyses. The third and final part of the chapter is devoted to a discussion of the major categories of preconditions. These include the socioeconomic status of the community, the types of technologies appropriate to these conditions, and the types of supporting conditions and complementary investments necessary to make the water and sanitation interventions successful.

The overall purpose of this chapter is threefold: (1) to define the concept of preconditions as given in the development literature, (2) to explore the range of preconditions relevant to water and sanitation interventions, and (3) to provide the basis for the development and analytical framework of preconditions in the next chapter.

3.2 Planning Inputs Versus Planning Constraints

In an abstract sense, planning consists of the organization of available inputs within the context of existing conditions and constraints in order to achieve desired outputs. Input resources are always limited; therefore, planning generally involves an attempt to maximize outputs while minimizing inputs. Planning for water and sanitation programs follows this same pattern. In order to achieve program objectives, the planner must determine the type and amount of input resources (personnel, materials, money) required for the existing conditions (size of community, level of expectations, absorptive capacity, supporting infrastructure).

Thus, planning must deal with two basic issues: the identification of conditions and constraints within which overall programs and their associated projects are developed and the determination of the corresponding inputs necessary to achieve program objectives. Since inputs must be tailored to meet existing constraints the two issues are closely related. Some constraints, such as climatic conditions, groundwater levels, and community size, are fixed and generally cannot be changed. Other constraints, such as water use practices availability of trained personnel, and road access, are influenced by a variety of interventions and, therefore, can be modified by the planner. These modifications may require complementary investments in addition to direct project inputs.

For example, the introduction of water seal latrines to a community may require an extensive program of health education to show the people how to maintain the new facilities and to convince them of the benefits of improved excreta disposal practices. The health education program in this case is an essential complementary input if the technical sanitation component is to be successfully adopted by the community.

To be successful, therefore, programs and projects may require a package of complementary investments tailored to fit the existing constraints. This is particularly true in water and sanitation programs, where ultimate program benefits are dependent not only on technical inputs but also on behavioral and institutional changes in the affected communities. For purposes of discussion in this chapter, existing conditions and constraints, as well as associated complementary investments, can be considered as part of the preconditions essential to program success.

3.3 Preconditions Required by Development Institutions

In contrast to the well developed guidelines generally available for project appraisal in the water and sanitation field, the major development institutions have developed only sketchy outlines for project identification and essentially none for program formulation. The distinction between appraisal and identification is important. Project appraisal normally constitutes a comprehensive review of a proposed project by a financing organization. It is normally the final step leading to the decision whether or not to finance the project. The World Bank designates studies at this level as Project Appraisal Reports (World

Bank, 1978; World Bank, 1980d), while USAID terms them Project Papers (USAID, 1981). Moreover, both institutions have developed detailed guidelines for economic analysis, social soundness, and environmental assessment which ar part of the overall project appraisal process. These guidelines have great value at this advanced stage of project preparation, but they are not very useful at the initial point of project planning.

Project identification, on the other hand, is still in its infancy, as neither the World Bank nor USAID have formulated planning procedures specifically for water and sanitation projects (World Bank, 1978; USAID, 1981). Both institutions, however, have made recent preliminary attempts at developing project identification guidelines within the context of the overall water and sanitation sector.

The World Bank has taken the lead in attempting to develop uniform guidelines for project preparation in the water and sanitation sector which could be used by the Bank, other international organizations, and local institutions in the developing countries. A recent report, commissioned by the World Bank, describes the pre-investment planning phase as having three distinct stages: indentification, pre-feasibility, and feasibility (Grover, 1981). Each of these stages results in a report which acts as a screening device to narrow down the possible options. The identification report is intended to identify a possible project and initiate the planning process. It is basically a desk study consisting of an overview of the need for a project and a brief description of the basic alternatives and order-of-magnitude costs. The pre-feasibility report is used to select a preferred project after considering long-term needs, existing system deficiencies, and system alternatives. Lastly, the feasibility report is intended to assist national and international finance agencies to decide whether to support a proposed project. The feasibility report acts as input into the appraisal report, which is drawn up by the financing agencies themselves.

Guidelines proposed to the Bank for the water and sanitation project identification report include the following aspects (Grover, 1981):

1. Definition of intended beneficiaries of the project, with a map showing the project area;

2. Statement of how the proposed project accords with national and regional development strategies;

3. Brief description of present water supply and sanitation services in the project area and deficiencies of these systems;

4. Existence or need for a strategic plan to guide the long term development of sector services in the project area. List of relevant background reports such as regional development plans, water resources studies, reconnaissance reports, etc;

5. Project objectives, including numbers and types of people to be served, anticipated standards of service and expected conditions in the project area after the project is completed;

6. Outline of proposed components of preferred project, including physical systems and software. Also outline of possible alternative projects for initial implementation;

7. Preliminary estimates of total and per capita costs for implementing the preferred project, including annual costs of future operation and maintenance. Indication of anticipated sources of capital and operating funds, with explicit reference to prospects for assistance from international agencies;

8. Indication of institutional responsibilities for the pre-feasibility and feasibility stages of project preparation. Also cost estimates and proposed sources of finance for these planning stages;

9. Outline of policy issues which need to be resolved before the project can proceed;

10. Preliminary terms of reference for pre-feasibility stage;

11. Schedule for all future stages of project development, indicating earliest date when project might be operational;

12. Recommendations for future action.

As can be seen, the above guidelines stress needs and objectives, existing conditions, proposed systems, future conditions, and financial implications.

WHO is also attempting to provide guidelines to assist developing countries in seeking external assistance. Through a concept entitled, "Project and Programme Information System," WHO is hoping to promote the initial stage of project and program formulation in countries participating in the International Drinking Water Supply and Sanitation Decade and, thereby, accelerate the process of external support by donor organizations. It has developed a two-page data sheet for summarizing information in a standard format on projects and programs for use by international institutions (WHO, 1981). The main elements in this sheet are the following:

1. Scope (describe type of work and activities involved in the project)

2. Background (describe existing studies, how project fits into national development plan, relationship of project to other projects, degree of community participation expected)

3. Responsible Government Agency

4. Institutional Support (describe operation and maintenance support, recurrent cost basis of project, and organization responsible for implementation)

5. Duration (of project and each phase)

6. Starting Date

7. Estimated Cost

8. Government Inputs (describe personnel, equipment and supplies, and funds)

9. External Inputs (describe personnel, equipment, and funds)

10. Sector Development Performance (describe related projects and government support to the sector)

11. Outputs (describe studies, institutional aspects, and investment projects that will come out of the project)

12. Government Priority and Commitment (describe if project is in national development plan and degree of priority)

13. Expected Benefits (describe benefitted populations, expected improvements in health and socioeconomic conditions, and personnel expected to be trained)

In summary, the above elements stress objectives, inputs, outputs, and benefits. The WHO data sheet represents a slightly more advanced stage in the project planning process than do the project identification guidelines of the World Bank.

Recent guidelines proposed for the Near East Bureau of USAID are more specific then those of either the World Bank or WHO regarding the preconditions necessary for project identification. Prepared by Goff and Burke (1980), the USAID guidelines lead to the preparation of a PID, the Project Identification Document. The proposed process involves four distinct stages prior to writing the PID:

Stage 1: familiarization with the water and sanitation officials and activities of other donors.

Stage 2: communication with host country government agencies to determine their water and sanitation plans, resources, and rural target areas.

Stage 3: visits to field offices, target areas, and current projects. The following preconditions should be reviewed:

1. Level of need for water and sanitation services.

2. Government commitment in goals, programs, budgets, levels of service, etc.

3. Consumer commitment in terms of activities and accomplishments.

4. Donor investments on past, current, and future projects.

5. Sector organization including both public and private institutions.

Stage 4: review of alternatives and preparation of the Log-Frame.* The following considerations should be used to develop possible project alternatives:

1. The target propulations to be served.

2. The costs and time period required.

3. The technologies and interventions to be employed.

4. The institutions to be involved, their roles, and inter-relationships.

Associated with the above USAID guidelines are two checksheets. The first checksheet is intended to explore the basic organization, activities, and operational procedures of the national and provincial ministries. The second checksheet is used to determine socio-economic conditions as well as water and sanitation problems and needs at the time of site visits. Although these checksheets are not accompanied by any recommended analytical procedures, they do serve to remind the planner to review the water supply and sanitation development objectives, the available institutional resources, the current social status of the communities, and the existing water and sanitation facilities. Upon completion of the four preliminary planning stages, the Log-Frame, and the two checklists, the results are written up as a formal PID,

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* The Log-Frame, or Logical Framework, is a methodological procedure for linking project inputs to overall USAID goals by means of explicitly stated indicators, assumptions and linkages (USAID, 1981).

which is the first step in the USAID project planning process (Goff and Burke, 1980).

In summary, several of the major development organizations are considering new guidelines for use in the earliest stages of program formulation and project identification. The proposed guidelines sponsored by the World Bank and WHO are intended for use by national officials, while those developed for the Near East Bureau of USAID are directed primarily at USAID personnel. For the most part, all guidelines are based on rapid reviews of existing conditions, rather than detailed investigations of hypothetical alternatives. The issues of concern in these guidelines usually include needs, objectives, community characteristics, possible interventions, institutional resources, and benefit potential. These issues are very similar to the series of five sub-assessments (water and sanitation problems, community characteristics, available interventions, resource interactions, and expected outcomes) which were presented earlier in Figure 2 as an illustration of the overall role of pre-conditions in program development.

3.4 Recent Studies of Social and Economic Factors

3.4.1 Basic Needs and Priorities

A recent approach to the development of water supply and sanitation programs involves identifying essential human needs and then designing program components to meet these needs. From a social science standpoint, the key aspect is the needs perceived by the members of the community themselves - the felt needs. Some attempt, however, has been made to identify universal needs applicable to all communities. Psychologist Abraham Maslow has suggested the following hierarachy of human needs (Dajani and Murdock, 1978):

(1) Physiological needs (food, shelter)

(2) Safety needs (protection from danger, disease, deprivation, and the unforeseen)

(3) Social needs (belonging, friendship, and love)

(4) Ego needs (status, recognition, self-confidence)

(5) Self-fulfillment needs (self-development, creativity, and volunteering)

Various attempts at operationalizing listings of human needs have been made. For example, Dajani and Murdock (1978) proposed that USAID address the following basic needs in rural Jordan:

(1) Basic material needs (food, nutrition, housing, clothing, water)

(2) Health (both curative and preventive care)

(3) Education (knowledge and skills, special and adult education)

(4) Income and economic opportunity (employment and income maintenance)

(5) Personal adjustment and social participation (child care, family planning, recreation, cultural and religious services, community organization, participation in decision making, etc.)

It is evident from the above hierarchies that the most basic needs are relatively easy to define and assess, while the more complex second and third order needs are much harder to clearly identify in the field.

The World Bank currently stresses the crucial importance of basic needs in program development aimed at improving the conditions of life of the poor, but it also recognizes that the composition of needs and the required goods and services varies in each country (World Bank 1980a). Although not yet fully developed, the Bank is moving towards a basic needs strategy. In general, recent publications of the Bank have emphasized a core set of needs which involve education, health, water, and nutrition. Education is measured as the adult literacy rate; health services are assessed in terms of the number of persons per physician and life expectancy at birth; water is defined as the percentage of population having access to safe water, and nutrition is given as the percentage of daily caloric requirements being met (World Bank, 1980b). Together these needs describe the fundamental goods and services the poor need in order to develop their own inherent potential and eventually participate in economic progress.

USAID has not attempted to formulate a specific, agency-wide basic needs approach. Instead it has concentrated on developing goals and priorities for the water and sanitation sector using the general concepts of need, growth, equity, and practicality. As of mid-1981, formal policies for the water and sanitation sector have yet to be adopted. However, several key aspects of Agency support can be discerned, namely support for the rural poor and a greater emphasis upon software, innovative water and sanitation programs, human resource development, and institutional development. Recent policy proposals have suggested that USAID consider funding water and sanitation programs under the following conditions (Bloom, 1981):

1. There is a clear need, evidenced by lack of access to adequate facilities and/or high prevalence of water and sanitation-related diseases.

2. There is a demand, expressed as a willingness by consumers to contribute towards the costs of new systems and a commitment by government to shoulder its share of the costs.

3. The responsible agency has the resources to assist in construction and operation of systems.

4. The infrastructure (especially roads) allows access to the systems for supervision, technical assistance, and supplies. Alternatively, minimal maintenance systems can be adopted.

A warning regarding the application of overly general policies to specific field situations was sounded by Burton (1979) in a discussion paper on USAID policies in rural water supply development. Burton argued that the following problem dimensions could not be easily handled by general policy pronouncements:

1. Settlement types

   Technology, or system design, should be selected according to the prevailing settlement pattern (dispersed versus concentrated) and in a manner harmonious with government settlement policy.

2. Wealth and accessibility

   Community wealth and accessibility to markets are usually correlated. A community well-endowed with these factors is more likely to demand, support, and maintain an improved water supply than a poor community.

3. Water availability

   There is an enormous range of variation in water availability. It is a function of both climate and geology.

4. Community organization

   The successful design, implementation, and maintenance of a community water supply system depends on the existing community organization and structure.

In Burton's view, the above issues preclude any easy generalization about the methods and, by implication, the policies to be employed in rural water development. The key to successful programs is flexibility in application and adaptability to local circumstances. Policies, in short, must be capable of encompassing the "rich diversity of real field situations" (Burton, 1979.)

3.4.2 Indicators and Indexing

One way of implementing policies in the field is through the use of indicators as a means of measuring selected conditions. Indicators are simply measurable variables that serve as proxies for more complex conditions or states of being. When indicators are expanded into measurement scales, called indices, they provide powerful analytical tools for both retrospective assessment and future planning.

An example of the use of indicators to compare countries within a geographic region, to assess relative country performance, and to determine the relative degree of country commitment was developed within the Near East Bureau of USAID (Binnendijk, 1978). This procedure was based on the rationale that Section 102(d) of the Foreign Assistance Act requires that USAID direct its assistance towards those countries which are in the greatest need of outside assistance and which will make the most effective use of such assistance to help their poor. To guide the allocation of this assistance, indicators were established to conform for the most part to the following general development goals of USAID:

(1) lower population growth
(2) better health and nutrition
(3) more widespread basic education
(4) better employment opportunities
(5) improved agricultural productivity
(6) rapid economic growth
(7) increased role of women in development
(8) improved access to shelter, water and electricity

The method developed by Binnendijk for the Near East Bureau used a series of statistical indicators to compare countries within a geographic region. The poverty status of a country was first assessed by comparing eight quality of life indicators drawn from national statistics against USAID targets, as shown in Table 6. To determine the relative progress, or performance, of countries, Binnendijk then recommended grouping them according to their per capita GNP, which became a proxy for level of development. This allowed the relative performance of a country to be assessed by comparing one of several national indicators against the mean value of that indicator for all countries in its per capita GNP range. Countries with low per capita GNP levels, therefore, were compared with nations having similar levels. Table 7 gives the means for 23 development indicators and the per capita GNP levels for some 30 countries for which data were available (Binnendijk, 1978).

Another approach to assessing relative performance was based on the fact that the mean values of the above indicators in each income group were related to increasing per capita GNP. In other words, as per capita GNP increased, the degree of goal achievement in each indicator also tended to increase. By statistically correlating indicator values against per capita GNP in all countries, an "expected" value for each indicator could be calculated and compared with the observed value. Thus, country performance towards achieving USAID development goals could be assessed by comparing the status of its development indicators against the values expected for a country at its GNP level (Binnendijk, 1979).

In a similiar manner, Binnendijk showed that the relative degree of commitment of a country to the above goals could be assessed by comparing indicators of resource inputs. Because of the inherent data problems in this type of statistical comparison, the writer warned against ranking countries and making aid allocation decisions exclusively on the

Table 6. Poverty Status of Near East Bureau Countries (Binnendijk, 1978).

Indicator	AID/PPC target	Afghanistan	Yemen	Egypt	Jordan	Morocco	Syria	Tunisia	Lebanon	Portugal
Crude birth rate per 1000 pop.	25 or less	51.4	49.6	37.8	47.6	46.2	45.4	40.0	39.8	19.2
Life expectancy at birth	65 years or more	41.0	37.0	52.4	53.2	53.0	56.0	54.1	63.3	68.7
Infant mortality rate per 1000 live births	50 or less	182	159	100	-	117	93	125	82	46
Calorie intake as percent of requirements	100 percent	82	84	113	99	106	107	94	92	118
Per capita protein intake (in grams/day)	60 or more 1/	58	61	69	65	62	75	67	63	85
Adult literacy rate (as percent of pop. age 15 and above)	75 % or more	14	10	40	62	24	40	55	68	65
Primary enrollment ratio (as percent of primary school age pop.)	98% or more	30	15	72	83	59	98	95	119	100
Per capita incomes for the lowest 20 percent of households (US $)	$277 in Latin America $178 in Africa $152 in Asia	-	-	72	-	95	-	110	215	-

1/ PPC has no official target; USDA recommends a minimum of 60 grams per day while FAO recommends 75 grams per day as minimum.

Table 7. Mean Values of Selected Indicators for Country Groups by Per Capita GNP Range (Binnendijk, 1978)

Goals	Indicators	Group 1 less than $250	Group 2 $250-$449	Group 3 $450-$649	Group 4 $650-$999	Group 5 $1000-$1999
Lower Population Growth	annual population growth rate	2.4	2.5	2.8	2.6	1.8
	percent of population under age 15	43.7	43.8	45 0	44.2	37 7
	crude birth rate per 1000 population	45.6	43.1	41.6	38 2	30 1
Better Health and Nutrition	life expectancy at birth	43 6	47.2	54.6	59.3	65 5
	infant mortality rate per 1000 live births	130	126	71	69	63
	calorie intake as percent of requirements	92	95	103	104	110
	per capita protein intake (grams/day)	56	57	56	65	78
More Widespread Basic Education	adult literacy rate for population 15 years and above	25	38	55	64	77
	primary gross enrollment ratio	53	70	93	98	101
Higher Incomes for the Poor	% of income received by highest 5% of households	25 9	29.8	28.4	27 8	24 7
	% of income received by lowest 20% of households	5.8	4.2	4.7	4.4	4.4
	per capita incomes in lowest 20% of households (US $)	42	69	114	180	285
Better Employment Opportunities	percent of labor force in agriculture	77	68	51	44	29
Improved Agricultural Productivity	rate of growth in agricultural production	1.6	2.6	2.0	3 5	1.8
	agricultural production per male agricultural worker (US $)	265	412	646	715	1260
	% of land owned by top 10% of owners	37.6	-	62.6	67.6	59 0
	% of land owned by smallest 10% of owners	1.9	-	1.1	0.7	1.0
Rapid Economic Growth	rate of growth of GNP	3.4	5.2	5.1	6.4	6.6
	rate of growth of per capita GNP	1.0	2.7	2.7	4.0	4.7
Increased Role of Women	primary gross enrollment ratio for females	42	59	86	89	94
	females as percent of total labor force	35	30	26	24	25
Improved Access to Shelter, Water and Electricity	% of population with reasonable access to water supply	14	34	43	47	61
	electric power consumption per capita (KWH)	39	136	253	355	758

basis of a simple set of quantitative indicators of performance and commitment. She recommended that the primary aid allocation decision be made on the criteria of need, with performance and commitment indicators used only to adjust aid levels upwards or downwards (Binnendijk, 1978).

The main requirement for indicators is a realiable data base, which includes comparable measurements in each of the areas of concern. Despite inherent weakness of interpretation, indicators remain popular because they provide a rapid means of assessment and through them different events can be readily compared. The problem has been, and always will be, to find indicators which are valid proxies for the condition being assessed.

Another use of indicators is in the development of indices which award point values for various levels of the variable being measured. As an example, Thayer Scudder has developed for USAID an index for the rapid assessment of the relative wealth of resettled communities. This index provides a maximum of five points for each of the variables of housing, water and sanitation facilities, home furnishings, farm equipment/transportation, and lighting. The sum of the scores in these variables provides a measure of the relative wealth of the community. Indexing also can be used to assess almost any mix of social, economic, and environmental variables. For example, the Ministry of Health in Uganda has sponsored an annual national housing competition in which indices were employed to compare the housing, food storage, water supply, latrines, trash disposal, and gardens of selected villages. The winning village was determined by the cumulative score for the observed variables.

The most promising indexing effort in recent years is the Physical Quality of Life Index, which is a composite measure of three indicators: infant mortality, life expectancy at age one, and basic literacy (Morris, 1979). These indicators measure results, not inputs, and are believed to be free of any particular pattern of development or social organization. Thus, the PQLI measures changes in basic welfare but not development or quality of life. Because it minimizes developmental and cultural enthnocentricity, the PQLI is claimed to be directly applicable to international and regional comparisons. Moreover, its emphasis upon the distribution of certain essential characteristics within populations makes it an ideal tool for a basic needs strategy.

The PQLI itself is a composite consisting of the average value of the three key indicators scaled from 0, the worst performance, to 100, the best performance. The scale of 0 to 100 was constructed on the basis of historical data and "reasonable assumptions" about best and worst performance. In determining the composite value, all three indicators were assumed to have equal weight. The writer warned that the PQLI does not measure economic growth, economic development, total welfare, or effort. Nor does it identify the need for individual projects. It can show, however, country performance and progress in providing certain social qualities to its population, and it can be used to identify specific types of underdevelopment and to classify countries needing various kinds of assistance. Table 8 illustrates the application of the PQLI to several low income countries.

The major weakness of a multi-variable indexing approach is that variables are all not equal in importance. Failure to recognize this

Table 8. Components of the Physical Quality of Life Index (Morris, 1979).

	(1) Population, 1970-75 Average	(2) Per Capita GNP, 1970-75 Average	(3) Physical Quality of Life Index	(4) Life Expectancy at Age One Index	(5) Infant Mortality Index	(6) Literacy (aged 15 and over)	(7) Life Expectancy at Age One	(8) Infant Mortality Rate
	(thousands)	($)[1]				*(%)*	*(years)*	*(per 1,000 live births)*
Low-Income Countries (42) (per capita GNP under $300)								
Afghanistan	18,129	137	18	25.4	21.2	8	47.9	182
Bangladesh	70,719	92	35	38 7	43 7	22	53.1	132
Benin	2,880	124	23	29.0	19.8	20	49.3	185
Burma	29,494	105	51	46.7	46.4	60	56.2	126
Burundi	3,558	111	23	20 5	35.6	14	46.0	150
Cameroon	6,117	273	27	21.8	41 4	19	46.5	137
Central African Empire	1,701	226	18	29.7	17 6	7	49.6	190
Chad	3,832	113	18	15.9	31.1	6	44.2	160
Comoro Islands	288	230[2]	43	40.3	31.1	58	53.7	160
Egypt	35,436	245	43	50.8	50.9	26	57 8	116
Ethiopia	26,415	97	20	31.3	21 6	6	50.2	181
Gambia	486	153	25	35.1	28.8	10	51 7	165
Guinea	4,169	126	20	27.4	24 3	9	48.7	175
Guinea-Bissau	506	120[2]	12	22 8	9.5	5	46.9	208
Haiti	4,394	176	36	50 8	35 6	23	57 8	150
India	578,175	133	43	45.9	48.2	34	55 9	122
Indonesia	127,756	203	48	42 6	41.4	60	54 6	137
Kampuchea (Cambodia)	7,585	70[2]	40	32 1	45 9	42	50 5	127

gives disproportionate influence to the less important variables. Techniques developed for environmental assessment purposes have attempted to minimize this problem by weighting each variable according to its estimated importance and providing a scale indicating the degree of achievement for that variable. The score awarded a variable is the product of the maximum point value times the percentage achievement (Dee et al., 1972). A similar approach was suggested in a report to USAID for the determination of implementation priorities for villages which had requested water supply projects in Lesotho (Metcalf and Eddy, 1977).

3.4.3. Checklists

Indicators are also being used as "checklists" in many current planning methodologies as a way of insuring that a minimum set of key factors are explicitly considered in plan development. Checklists provide a means of insuring that pre-determined topics or questions are brought to the attention of planners. They do not constitute a rigorous method of analysis because they rarely have firm criteria for application in planning situations. Their main advantage is that they provide the relatively unskilled planners with step-by-step procedures for identifying and evaluating information.

WHO is a strong advocate of checklists in program and project preparation, and especially so with regard to the International Drinking Water Supply and Sanitation Decade 1981-1990. Often these checklists take the form of a series of questions, as illustrated in the following checklist for assessing the social and economic potential for community education and participation (CEP) in water supply and sanitation (Whyte, 1980):

1. What are the relative proportions of nucleated and dispersed populations which need services?

2. What socio-economic issues exist which may influence CEP potential?

3. What religious or ethnic beliefs exist which may influence the design of the CEP component?

4. What existing services have involved CEP and what can be learned from them?

5. What is the economic base of communities which can be used to pay for services?

6. What levels of education can be expected?

7. What rights and obligations exist between members of a community?

8. What access to media do communities have?

9. What are the traditional water rights and beliefs?

10. Are there major social and cultural differences within communities?

11. Who are the best communities leaders for water supply and sanitation projects?

12. What aspects of community decision-making patterns need to be considered?

13. What traditions of self help are there?

14. What has been the role of women and what is its potential over the next ten years?

15. What health-related attitudes and practices must be taken into account?

16. What is likely to be the community's willingness and capacity to pay?

For each of the above questions, Whyte provided a checklist of factors to consider. For example, the factors for question 16 included:

- amount and reliability of income
- cash/kind contribution
- seasonal variation
- household variation
- payment for other services
- attitude to paying for water

- other cash purchases and expenses

The World Bank has developed its own checklist consisting of an extensive series of questions for the appraisal of water supply and sanitation projects. Many of the factors contained in this checklist are relevant for project identification as well as project appraisal. According to the Bank, the objectives underlying its checklist are as follows (World Bank, 1980d):

> The main objective of a rural water supply scheme is to provide safe water, easily accessible, in quantitites adequate for drinking, food preparation, personal hygiene, and sometimes small livestock at a cost in keeping with the economic level of the communities and through facilities which can be easily operated and maintained at a local level. The objective of the sanitation component is to provide means for the safe disposal of human excreta through low-cost easily-maintained facilities, thus completing the effort to protect the health of the people.

The above statement shows the strong correlation perceived by the World Bank between water and sanitation projects and health. Since health benefits, in the Bank's view, cannot be quantified at present, it recommends that the following socio-economic indicators be used for project justification (World Bank, 1980d):

1. Determine the need for the project.

2. Determine if the project meets the needs of the community at least cost.

3. Determine if the community has the technical and financial capacity and social-administrative structure to operate and manage the system.

4. Determine project rankings on the basis of
   (a) Seriousness of water-related disease
   (b) Possible cost reductions in obtaining water
   (c) Poor quality and seasonality in existing sources
   (d) Potential for future economic development
   (e) Interest of the villagers
   (f) Settlement size
   (g) Accessibility of village
   (h) Per capita cost

The overall procedure for project appraisal within the World Bank follows the six steps summarized below (World Bank, 1980d):

1. The water supply and sanitation sector.

   Describe the sector, the principal organizational entitites, and the rural communities; provide information on national targets for service, planning, financing, and institutional development; describe local contributions in labor and materials and existing efforts in sanitation and health education.

2. Previous Bank involvement in rural water supply and sanitation.

   Describe completed and ongoing projects; assess performance of executing agency; assess role of government counterpart funds and degree of community self-help; describe operation and maintenance requirements; assess overall system designs.

3. Existing water supply and sanitation conditions in the project area.

   Describe the areas, basic socio-economic data, health problems, levels of service, water resources, and rural population characteristics; identify participating agencies and assess their needs.

4. Description of the water supply and sanitation components of the project.

   Give basic details about the institutional, technical, and financial aspects of these components; describe the extent of community participation, the willingness to participate, and the types of training provided.

5. Project cost and financing plan.

   Describe the capital elements and outside support assistance; identify sources of financing; assess government performance in providing funds.

6. Justification.

   Describe village organization and community water and sanitation needs; assess village growth potential; compare per capita costs with other villages; assess accessibility, reliability, quantity, and quality aspects.

3.4.4 Social Soundness Analyses

Other models of social analysis in general and social soundness assessment in particular are available. The USAID Handbook 3 states that "the work of social analysis is expected to begin in the earliest stages of project development and continue through to completion of the PP" (USAID, 1981). Applicable models, however, are described in only general terms. At the Project Identification (PID) stage, USAID is concerned primarily with beneficiary participation and impact. Handbook 3 urges the planner to answer the following questions in the PID:

1. Who will participate?
2. What need will be met?
3. How will benefits be distributed?
4. How will benefits be sustained?

At the USAID Project Paper stage, social analysis is focussed on the operational linkage between the proposed project and the intended participants and beneficiaries. According to Handbook 3, the social analysis must assess the extent to which the proposed project is consistent with the following principles:

1. Compatibility
    - Describe the socio-cultural environment.
    - Summarize how the needs and capabilities of participants/beneficiaries have been taken into account.
2. Participation
    - Summarize the extent of beneficiary input to project design.
    - Describe how successful participation in project implementation/operations will occur.
3. Equity
    - Discuss features of the project that will facilitate the flow and equitable distribution of benefits.

4. Impact

- Discuss how participation in the project will lead to benefits.
- Discuss how beneficial activities will be sustained after USAID funding has ended.
- Discuss how project activities can be replicated or spread.

Handbook 3 indicates that carrying out the above social soundness analysis could require between several weeks and several months, depending upon the size of the project area. It stresses that precision is important and quantitative data should be developed wherever possible. As mentioned earlier, however, the model is discussed only in the most general terms and no specific quantitative criteria, such as are available for economic feasibility studies, are given for social analyses.

The lack of specificity and the absence of quantitative criteria are characteristic features of all social soundness models. They are symptomatic of the fact that, first, the use of social variables in the analysis of project investments is a relatively new and still unknown area and, second, social variables are not amenable to the same forms of measurement employed with physical or economic factors. Given the current low level of understanding of social analysis as an input to project development, a reasonable approach would seem to be to initially identify basic social factors common to many water and sanitation situations and then to further identify those factors which have been found in other studies to be associated with project success. The following models of social analysis are presented with this approach in mind.

Elmendorf and Buckles (1978) have recommended a "dialogue approach" for understanding the socio-cultural dimension of appropriate sanitation technologies. This approach requires significant amounts of consultation with the community through the use of promoters or "facilitators" who act as links between the agency and the community. The authors added that successful project identification requires that preliminary technical feasibility studies be kept brief (to avoid villager frustration), that local institutions be recognized (for genuine local participation), and that local committees be selected according to custom (not necessarily by a democratic vote). Most of all, however, communities must become concerned about their sanitation problems and either identify them as a priority need or link them to other felt needs, such as clean water health care, or home improvement (Elemendorf and Buckles, 1978).

A social soundness model drawing upon many of the social, economic and behavioral concepts of recent years was developed by Dajani for USAID in his assessment of the Amman water and sewerage systems (Dajani, 1978). Using the concept of sequential levels of evaluation Dajani proposed a model which began with basic information on the socio-economic setting and the water supply and sewerage systems. It then incorporated the factors of accessibility to the water and sewerage system, followed by the degree of utilization of the system, and finally by the occurrence of benefits. The key aspects of the model were a series of intermediate, measurable variables which correlated strongly with the intended health, social, and economic outcomes of the water and sewerage system improvements. Because direct causal and quantifiable relationships between system improvements and ultimate benefits were difficult to obtain, the intermediate variables were used as "surrogates" for the expected benefits. As shown in Figure 6, these intermediate variables were (1) access to the water and sewerage system, defined in physical, economic, and temporal terms, and (2) usage of the system, measured in terms of actual water use and the number of sewer connections made.

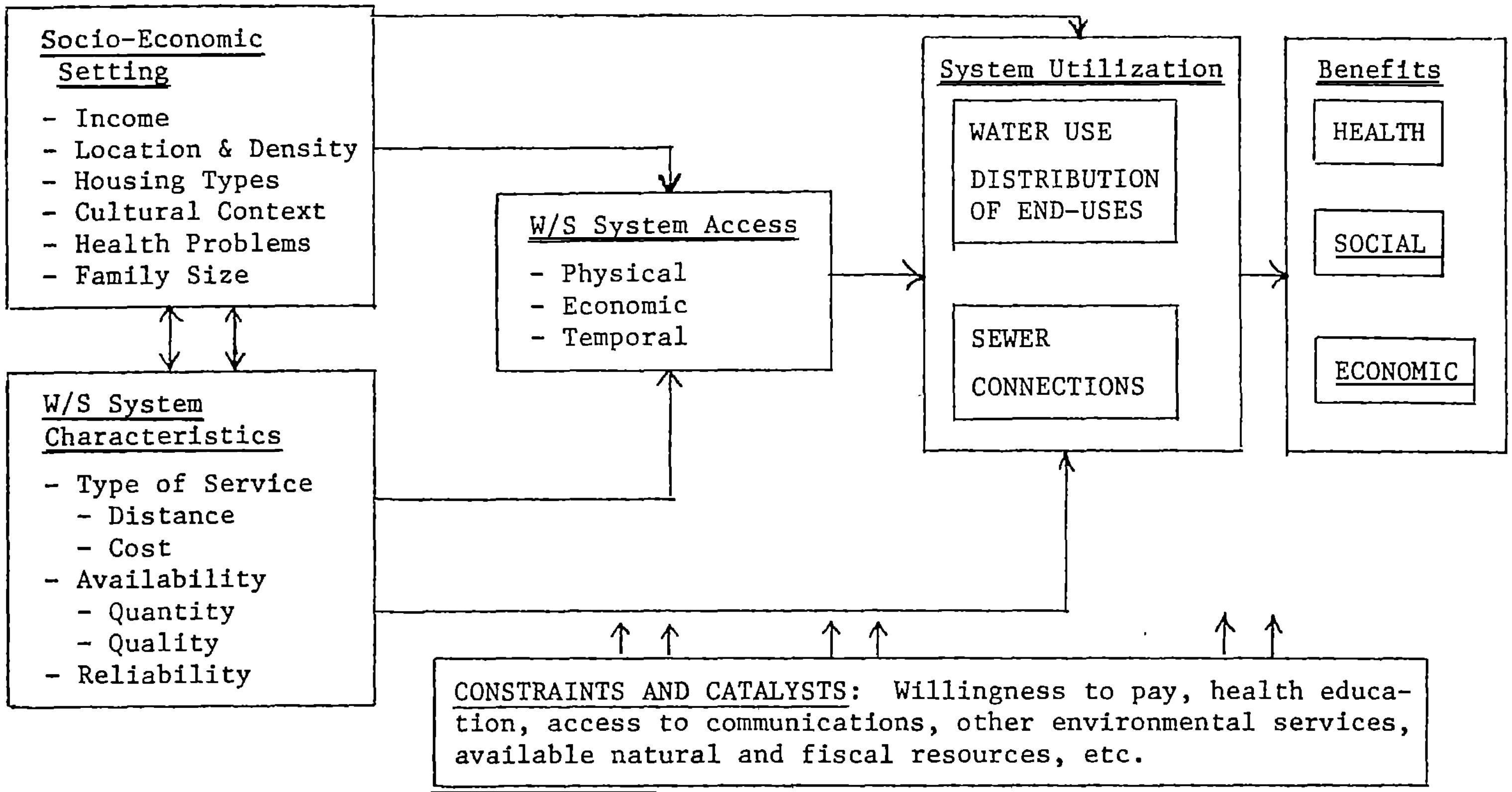

Figure 6. A Conceptual Framework for Social Soundness Studies of Water and Sewerage Systems (Dajani, 1978).

In the above social soundness model developed by Dajani, the intermediate access and usage variables were influenced by the socio-economic setting, the technical characteristics of the water and sewerage system, and a host of intervening "constraints" and "catalysts." The socio-economic setting which was based upon population, income distribution, and household composition, was closely related to the extent of poverty in given areas of Amman. The water and sewerage system, on the other hand, was defined in terms of the level of service, user costs, and the quantity, quality, and reliability of supply. At the intermediate level of the model, Dajani considered the aspects of willingness to pay and the level of awareness of personal and family hygiene to be very influential towards achieving system utilization. He stressed that health and socio-economic benefits can begin to materialize only when the system is utilized (Dajani, 1978).

In 1979, Self investigated the social aspects of water supply schemes for USAID in an attempt to improve site selection and design (Self, 1979). Basing his work on the existing literature, Self gave particular emphasis to the causal relationships between water supply improvements and resulting benefits, to the use of social analyses by other development organizations, and to the identification of major social parameters affecting benefits. He decided that benefits accrued through four dimensions of water systems: accessibility, quantity, quality, and reliability. The achievement of benefits, however, was dependent upon the water systems being accompanied by a carefully designed package of complementary inputs, consisting of hygiene education, a sanitation component, community involvement, and support and education for maintenance. These inputs were seen to be essential in order to bring about necessary changes in social behavior, especially with regard to hygienic practices, and the development of an effective maintenance system, which was dependent upon village motivation and the organizational model of the project. Motivation, in turn, was based upon local understanding of causal relationships between water and health, the impact of the project upon village leaders, and the influence of community participation and decision-making in the village.

According to Self, local decision-making played a significant role at the following points in the planning process (Self, 1979):

1. Deciding whether or not to apply for a project.
2. Selecting technically feasible alternatives.
3. Setting pricing policies.
4. Setting social controls for system use and maintenance.
5. Monitoring construction, operation, and maintenance.

Similarly, community participation in water supply projects was enhanced by the following factors (Self, 1979):

1. The project is requested by the village leaders.
2. Government policies encourage village involvement.
3. Outside experts work closely with villagers.
4. Government uses a decentralized administration.
5. The project is supported by the local leaders.
6. Tradition is utilized in the mobilization process.
7. A short start-up period is employed.

Thus, project success was linked to a package of complementary inputs and various pre-conditions involving motivation, local-decision making, and community participation.

A review of the various international organizations by Self revealed that none of them were actively involved in the social analysis of development projects. Guidance from these institutions was limited to a suggestion from the Pan American Health Organization that the selection of communities for water projects be based upon the following criteria (Self, 1979):

1. Communities that have expressed interest, have requested the system and have offered financial or other assistance for construction and operation.

2. Communities where projects can avoid unusual or expensive solutions.

3. Communities with the largest number of inhabitants (not more than 2,000).

4. Communities with access by roads for trucks.

5. Communities located within one of the zones of influence of national or local development plans.

Self concluded that projects were more likely to succeed under the following conditions (Self, 1979):

1. The community is fully aware of costs and benefits of alternative systems and helps in the selection process.

2. A local committee helps to set priorities and management procedures.

3. Communication is fluid between the community and the project personnel.

4. Tariff structures are understood and accepted.

5. The project design has allocated funds or a feasible process for collection of funds to meet recurrent expenditures.

6. The plan includes a training program for maintenance manpower.

7. The project uses and strengthens local political and/or indigenous organizations whenever feasible.

8. The village kinship and stratification structure is considered in the supply scheme.

9. There is assurance of good utilization of facilities by discussion and local understanding of the link between water, sanitation, personal hygiene, environmental hygiene, and health.

The following checklist of indicators for the social analysis of potable water projects was also included in Self's paper. They were intended to determine project need, social impact, project acceptance and utlization, and ultimately project absorption and success in terms of quality of life impacts (Self, 1979):

I. Social Profile and Social Impacts

1. Demographic survey: present and forecasted change (including population, settlement, income, employment, education, and migration indicators)

2. Health statistics (including infant mortality, life expectancy, health problems and disease incidences)

3. Water: technical (including sources, distances, collection times, seasonal reliability, water quality, per capita consumption, water uses)

4. Benefits and beneficiaries (including community level and individual level benefits)

II. Social Feasibility

1. Cultural setting - values, attitudes, and behavioral characteristics (including existing patterns and likely changes in values, attitudes and behavioral characteristics)

2. Structural constraints (including organizational and institutional responsibilities and activities related to capacity for system maintenance)

3. Feasibility of participation (including methods of community participation in decision-making, implementation, or evaluation)

4. Physical maintenance component (including recurrent expenditures, manpower training, maintenance planning, and water rate collections)

3.4.5. Conclusions from Social Analyses

If only one conclusion is to be drawn from the previous sections, it should be that social analyses play an essential role in almost all aspects of the development of programs and projects in water supply and sanitation. Social analyses can contribute to basic policy formulations, comparisons of basic welfare, planning guidelines, and overall program design. The issue here is to determine the extent to which social analyses are relevant in program formulation and project identification.

The concept of basic needs seems to be well-suited to the development of policies and their resulting programs. A basic needs policy is a clear recognition of the very elemental purposes of water supply and sanitation. It highlights the fact that most people in the rural areas of developing countries do not have minimum acceptable levels of service. Therefore, policies arising from a consideration of basic needs are policies aimed at reaching the vast majority of the population rather than special interested groups. At present, the World Bank is actively moving towards a formal basic needs policy in the areas of health, education, shelter, and water and sanitation. USAID, on the other hand, has not attempted to develop an official basic needs policy, but it has used the language of basic needs as official goals for many years.

Once policies have been formulated, indicators provide a means of translating them into operational guidelines. Bennendijk (1978, 1979) showed how general development goals could be used to formulate statistical indicators for comparing the poverty status, performance, and commitment of countries within a geographic region. The results of these comparisons were a measure of how successful countries were in terms of the initial goals. The writer cautioned against making primary aid allocation decisions on the basis of these indicators and suggested instead that they be used to supplement decisions made on the basis of need.

The Physical Quality of Life Index (Morris, 1979) offers great promise as a useful measure for determining basic welfare. It is a composite of three indicators - infant mortality, life expectancy at age one, and basic literacy - which are measures of results and which are claimed to be free of most developmental and cultural biases inherent in the great majority of development indicators. The PQLI appears to be applicable for measurements at the national, regional, and possibly the project level. To date, however, little empirical verification exists regarding the actual use of the index for planning purposes, and this approach must remain experimental until field tests have been conducted. Nevertheless, even without field verification, the PQLI has been used by a number of international organizations to compare the relative quality of life status of selected countries.

Despite their liabilities, indicator variables and indices provide the best means of making rapid assessments at the initial program formulation or project identification stage. They are tools which the planner can use on a routine basis to incorporate general policies and goals into the planning process and to prepare analyses which allow inter-project comparisons. The problem always will remain of finding reasonable indicators of the development conditions under concern. The previous sections have shown that such indicators are possible and are being used by development-oriented institutions.

Checklists provide a means of ensuring that all relevant issues are considered during the planning process. Unlike indicators and indices, checklists do not act as proxies for development conditions. Instead, they are a mechanism for encouraging the planner to think about situations which usually are too complex for straightforward measurement. Where indicators tend to be specific but narrow in scope, checklists tend to be general but comprehensive in scope. Checklists serve as practical method of incorporating social and economic concerns in the planning process. Unfortunately, the lack of methodological rigor found in most checklists also means that the concerns they raise can be easily ignored. The checklists developed by the World Health Organization (Whyte, 1980) and the World Bank (1980d) provide examples of current approaches within the development community.

Incorporating formal social soundness analyses into development procedures continues to be a difficult task. Few operational guidelines are available, although increasing attention is being given to this issue. Within USAID, guidelines for the Project Identification Document (PID) deal with who, what, and how in only the most general of terms. The guidelines for Project Papers provide more background information on aspects of compatibility, participation, equity, and impact, but almost no operational guidance is given for actual measurement in the field (USAID, 1981). This situation merely reflects the facts that the use of social analyses in project investment decisions is still relatively new and the measurement of most social situations is a highly complex undertaking.

Several writers have suggested methods for incorporating social analysis into the planning process. Elmendorf and Buckles (1978) have stressed the need for a "dialogue approach" using promoters or facilitators to act as links between the agency and the community. Dajani (1978) proposed the use of a broad-based social soundness model having many of the characteristics of the revised impact assessment model presented earlier in section 2.5.6. The Dajani model was based upon sequential levels of evaluation starting with system characteristics, proceeding with factors of accessibility and utilization, and concluding with the health, social, and economic benefits of water and sewerage systems. Self (1979) synthesized the available literature and concluded that the achievement of benefits from water and sanitation improvements needed various pre-conditions (motivation, local decision-making, and community participation) plus a carefully designed package of complementary inputs (hygiene education, sanitation, community involvement, and maintenance education).

In conclusion, social analyses can and should be incorporated within all stages of the planning process. This is especially important in the program formulation and project identification phase where issues of policy, local needs, and project selection must be made. The concepts of basic needs, indicator variables, indexing, and checklists, therefore, are all relevant to the development of guidelines for the identification of preconditions for water and sanitation programs.

3.5 The Influence of Socio-economic Status

One of the more challenging concepts of current development theory is that of absorptive capacity, or the extent to which a given community can effectively utilize a development input. Recently, Shuval et al. (1980) proposed what they termed a general theory on the relationship of water supply and sanitation investments to health. Calling it the Threshold-Saturation Theory, the writers claimed that the parameters of sanitation level, socio-economic status (SES), and health status were related, as shown in Figure 7. Thus, for a given socio-economic level, greater investments in sanitation resulted in larger improvements in health status.

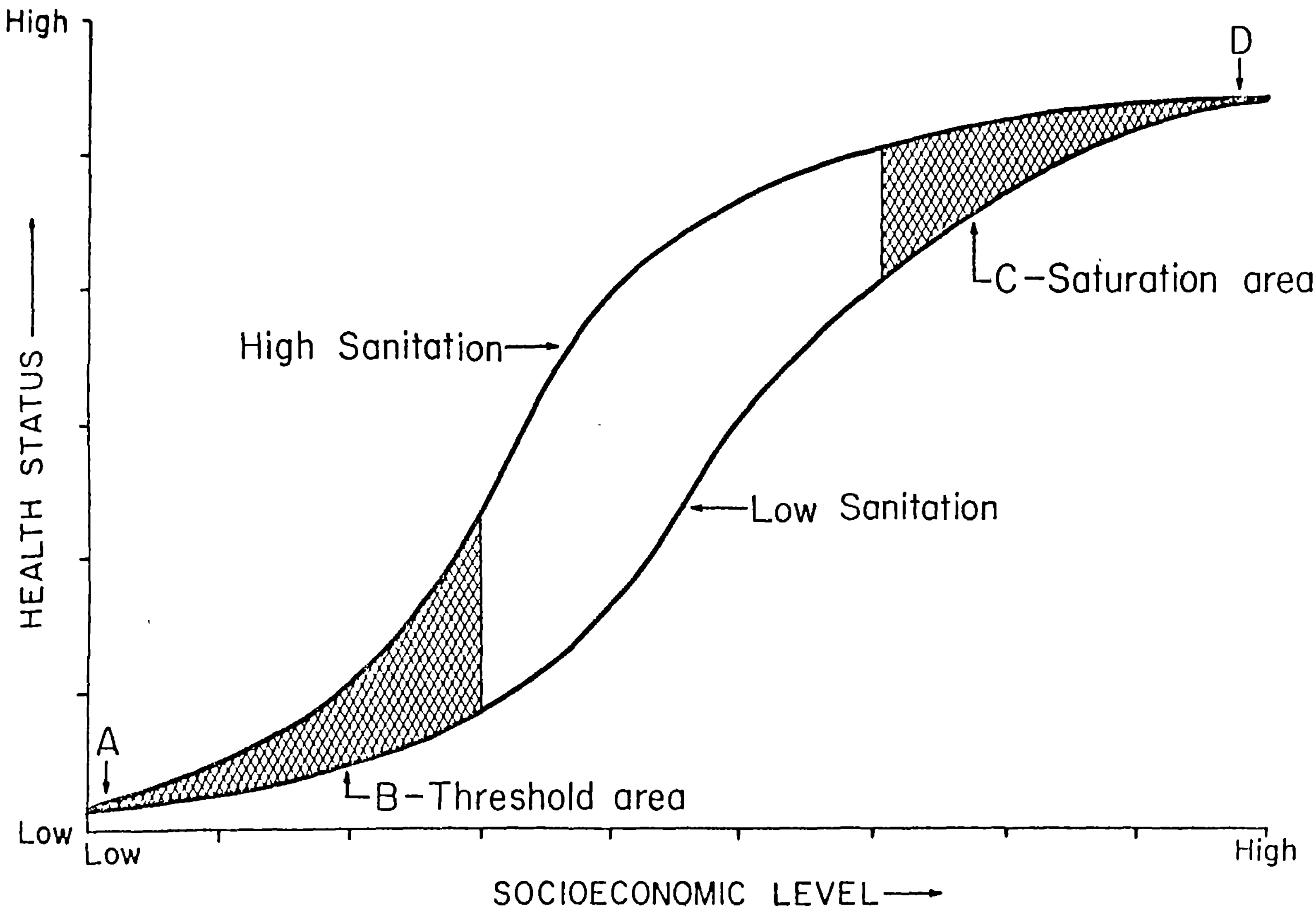

Figure 7. The Threshold-Saturation Theory of the Effect of Sanitation on Health Status at Varying Socioeconomic Levels (Shuval et al, 1980).

The innovative aspect of the Shuval et al. theory, however, was a threshold area at low socio-economic levels in which communities were unable to show improvements in health as a result of improvements in sanitation. According to the authors, a single intervention of improved sanitation in poor communities having low levels of nutrition and personal hygiene had little affect upon the multiple routes of disease transmission that exist. At higher socio-economic levels (the mid-range of the two curves in Figure 6), they expected a greater health improvement in response to sanitation investments. This process continued until a saturation area of rapidly diminishing health response was reached at the highest socio-economic levels. At this point, the high existing health status was assumed to reflect the improved nutrition, personal hygiene, housing, education, and other private and public health measures already available in the communities. Introducing improved water supply and sanitation facilities, therefore, would have only a minor incremental effect upon health.

Shuval et al. empirically tested their theory with statistical data from 65 developing countries. Indicator proxies were established for each of the three main parameters. Health status was taken to be life expectancy at birth; socio-economic status was represented by the percentage of the adult population who were literate, and sanitation level was measured as the percentage of the urban population with access to piped water supplies. All data were based upon countrywide statistics. The authors found that a plot of life expectancy at birth versus adult literacy for each of the 65 countries resulted in S-shaped logistic curves somewhat similar to those shown in Figure 6. Although the curves were incomplete at both the left end (threshold) and the right end (saturation), the results of the analyses, according to the authors, "indicate some tentative empirical support" for the threshold-saturation theory (Shuval et al., 1980).

In general, the Shuval et al. model is basically another attempt to identify indicator variables as measures of welfare or development status. As described earlier, such measures provide readily measurable proxies of otherwise complex situations. The PQLI is the most notable example of indicators being used to determine welfare status. The threshold-saturation model, however, attempts a far more ambitious task than other indices by postulating a dynamic relationship between sanitation level, socio-economic status (SES), and health status. The authors claimed that at low levels of SES, as well as at extremely high levels, improvements in sanitation alone cause little change in health. It is only within the intermediate range of SES, therefore, that sanitation interventions can be effective in improving health.

Although the threshold-saturation model is not yet sufficiently developed for use in program planning, it can be used to explain some of the interrelationships between levels of development, benefit constraints, and complementary inputs. At low levels of development (low SES), the lack of supporting institutions, infrastructure, and related programs represent a series of constraints upon the effectiveness of single sanitation interventions to improve health. Numerous complementary inputs, therefore, are needed to remove these constraints and allow the health benefits to occur. At high levels of development (high SES), the support facilities are all in place, but health status also is high and, again, sanitation improvements are unlikely to have much further effect. Such improvements may bring about greater social and economic benefits, but not greater health benefits. It is at the crucial middle level of development, where there exists some degree of infrastructural and institutional support, that the lack of proper sanitation itself may be the key constraint on health. Under these conditions, sanitation investments at this level, along with a few carefully selected complementary inputs, may cause a significant improvement in health.

3.6 The Influence of Technology

An issue receiving increasing attention in recent years is that of selecting water and sanitation technologies appropriate to the social and economic conditions of the project communities. Appropriate technology does not necessarily mean simple technology. Instead, it is technology specifically designed for the conditions in which it must function. Depending on site conditions, local expectations, and income levels, a basic pit latrine, for example, may be adequate for a small rural community but a flush toilet system may be necessary for a modern urban center. Both types of technologies are appropriate to their social, economic, and physical environments.

Although technological selection should be based primarily upon the existing socioeconomic conditions of the community, consideration must also be given to the type and availability of supporting infrastructure. For example, projects resulting in increased water usage (inside house connections) may require improved drainage systems to handle the corresponding increased quantities of wastewater. Similarly, sanitation schemes involving the use of water (water seal latrines, flush toilets) must have the necessary supply to be feasible.

There are a number of characteristics of water and sanitation systems which can be used to assess the influence of technology upon program and project success. These characteristics include system design, capital and recurrent costs, manpower requirements, maintenance needs, levels of service, and potential benefits. They tend to be interrelated, in that a change in one characteristic causes generally predictable changes in all other factors. For example, water supply design can range from a simple household well to a complex municipal treatment and distribution system. As designs become more sophisticated, costs tend to increase along with manpower requirements and maintenance needs.

System design often can be ranked within a hierarchy of improvements or levels of service. White et al. (1972) defined six levels of improvements, as shown in Figure 8:

- Class 0 - No improvement in natural water source (water hole, river, spring)
- Class 1 - Simple household improvement of private water source (hand-dug well, roof catchment with cistern)
- Class 2 - Simple group improvement of common water source (dug or drilled wells, possibly with handpumps)
- Class 3 - Rural pipeline to farm storage tanks (no water treatment)
- Class 4 - Piped system to communal standposts (with water treatment)
- Class 5 - Piped system with single-tap house connections (with water treatment)
- Class 6 - Piped system with multiple tap house connectors (with water treatment)

According to White et al., the success of any particular improvement in a rural community depends upon the choice of the individual user, who is

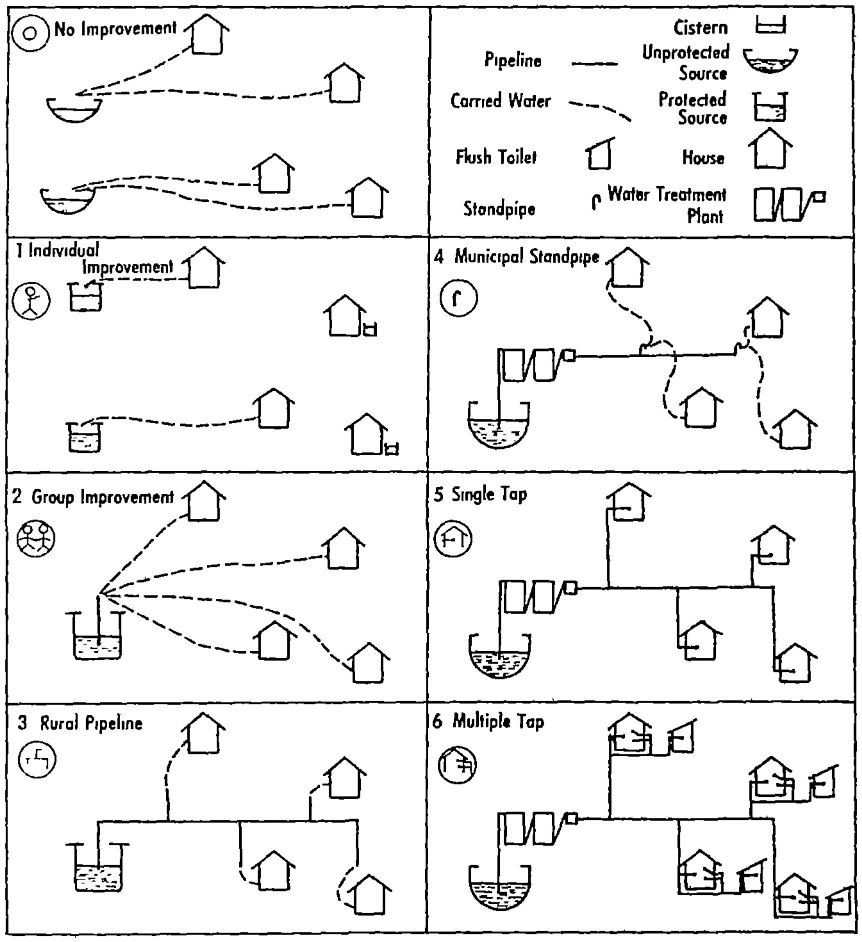

Figure 8. Types of Water Supply Improvements (White et al, 1972).

concerned with issues of water quality, the difficulties of drawing water at the source, and the possibility of meeting other people during the process. Thus, the technology must be appropriate to the situation, but the success of the system will depend upon non-technical issues.

The term "level of water service" can be used to classify both water supply and sanitation systems. For water supplies, service levels include (1) hand carrying, (2) yard tap or household pump, and (3) house connection. For sanitation, the service levels are related to the availability of water. Thus, if water is carried by hand, generally only pit latrines, and sometimes water seal (or pour flush) toilets, are possible. If water comes from a yard tap or household pump, water seal toilets as well as septic tanks become practical. Finally, water supplied through house connections allows conventional sewerage to be developed. Some sanitation technologies, such as bucket latrines and composting toilets, are not dependent upon the level of water service and, therefore, are better classified according to cost, local acceptability, or health factors.

The World Bank currently is urging planners to consider staging sanitation improvements over time as local demand increases and water service levels improve (Kalbermatten et al., 1980b). The initial sanitation facility could consist of an improved ventilated pit (VIP) latrine. When the community water supply system is converted to yard taps, the dry latrine would be converted to a water seal latrine. And when the water service is again upgraded, this time to house connections, the resulting large volume of wastewater could be disposed of through a small-bore sewer, which would also permit the installation of flush toilets.

Another classification of sanitation systems is to divide them into household and community technologies (Kalbermatten et al., 1980b):

Household sanitation technologies:

1. Pit latrines
2. Pour-flush toilets
3. Composting toilets
4. Aquaprivies
5. Septic tanks

Community sanitation technologies:

1. Bucket latrines
2. Vault toilets with vacuum cart collection
3. Communal facilities
4. Sewerage

These technologies can be further classified in terms of wet versus dry systems and in terms of on-site versus off-site disposal. Figure 9 illustrates a general classification of sanitation systems on the basis of these functional terms. Estimated costs for these systems are shown in Table 9.

Identifying technically feasible water and sanitation systems is relatively straightforward. It involves knowing the range of technological alternatives, the physical and environmental characteristics of the site, and the availability of resources. Selecting a system appropriate to the overall physical, social, cultural, and institutional constraints, however, is a much more complex task. Kalbermatten et al. (1980b) argued that this problem should be addressed by using multidisciplinary planning teams consisting of an engineer, financial analyst, economist/planner, and sociologist and by developing new methods of financing.

The same writers (Kalbermatten et al., 1980a) also suggested using algorithms, along with information on climatic conditions, site condi-

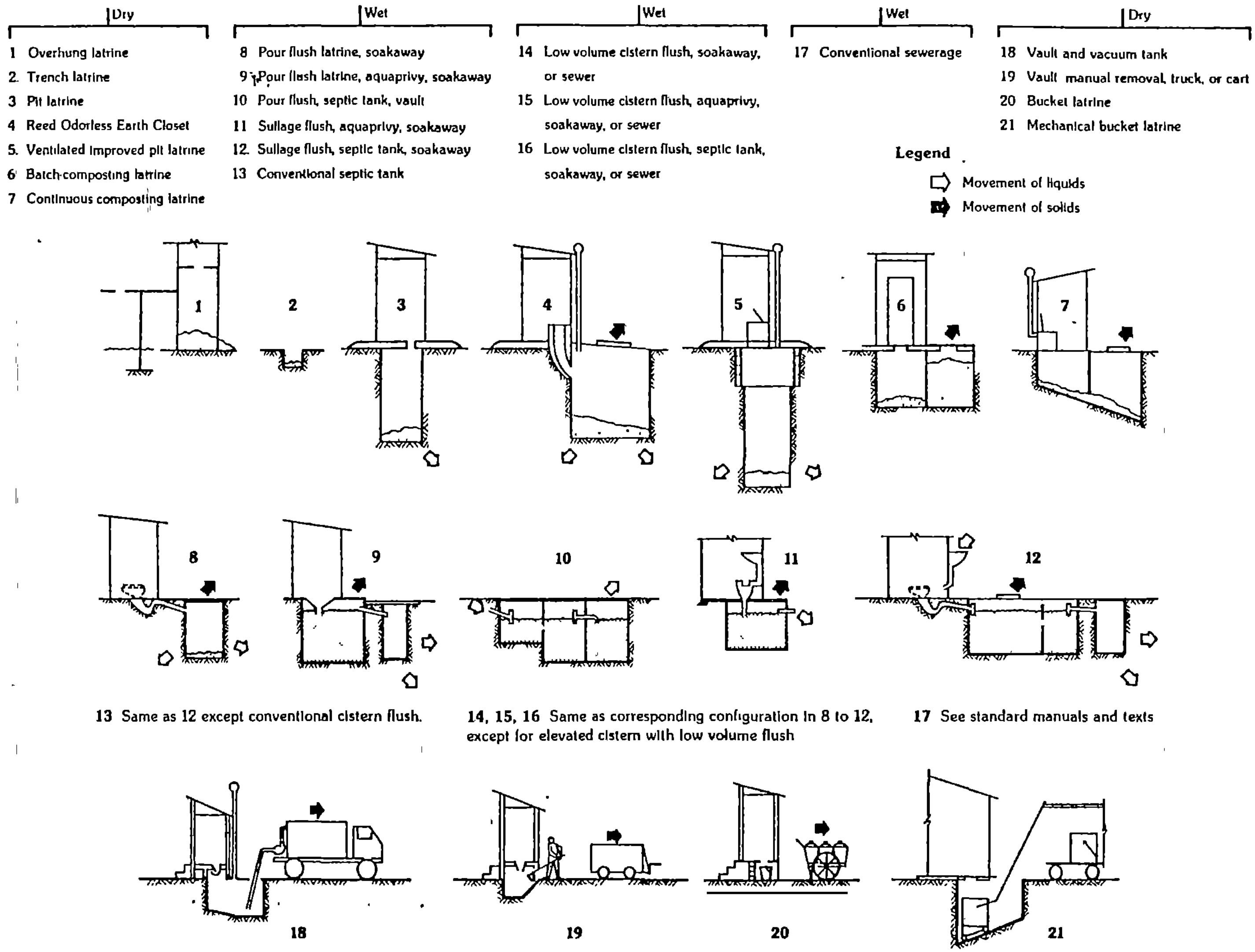

Figure 9. Generic Classification of Sanitation Systems (World Bank, 1980a).

Table 9. Capital and Recurrent Costs per Household for Sanitation Technologies (Kalbermatten et al. 1980).

Facility	Total investment cost	Monthly recurrent cost	Hypothetical total monthly cost a/	Percent of income of average low-income household b/
Low cost				
PF toilet	70.7	0.5	2.0	2
Pit latrine	123.0	-	2.6	3
Communal facility a/	355.2	0.9	8.3	9
Vacuum truck cartage	107.3	1.6	3.8	4
Low-cost septic tanks	204.5	0.9	5.2	6
Composting latrine	397.7	0.4	8.7	10
Bucket cartage b/	192.2	2.3	6.3	7
Medium cost				
Sewered aquaprivy	570.4	2.9	10.0	11
Aquaprivy	1,100.4	0.5	14.2	16
Japanese cartage	709.9	5.0	13.8	15
High cost				
Septic tanks	1,645.0	11.8	25.8	29
Sewerage (design population)	1,478.6	10.8	23.4	26

a. Assuming investment cost is financed by loans at 8 percent over five years for the low-cost systems, ten years for the medium-cost systems, and twenty years for the high-cost systems.

b. Assuming average annual income per capita of $180 and six persons per household.

tions, population, environmental sanitation, socio-cultural factors, and the institutional framework, to guide the selection and design of the most appropriate sanitation technology. These suggestions reinforce a basic precept that should be supported by all water and sanitation system planners: the determination of technical feasibility is only one of several essential inputs into the selection of an appropriate technology.

3.7 Complementary Investments

Complementary investments are additional program inputs intended to remove constraints or to provide additional assistance to the primary water and sanitation intervention. Such investments may be a direct component of the water and sanitation plan or they may be indirectly supplied by an unrelated investment. An example of the former would be a maintenance training component associated with a water system construction program, while an example of the latter would be all-weather market roads built by the Ministry of Public works in communities scheduled to have water systems constructed by the Ministry of Health. In both cases, the complementary investment is necessary for ultimate program success, but in only the first instance is it a direct part of the water program.

The literature provides a number of additional perspectives on the concept of preconditions. In reviewing the Kenyan water supply development program, Carruthers (1973) pointed out that water investments in rural areas required a number of complementary conditions for complete success. For example, the immediate direct benefits of time and energy reductions, increased water consumption, higher water quality, and improved supply reliability required the following complementary conditions for the first order benefits of released labor, improved labor quality, improved hygiene and health, and reduced risks of supply failure to occur:

1. The new source of water supply must be used by the consumer in place of the traditional source.

2. Sufficient water must be used to generate health benefits.

The first order benefits then become pre-conditions for the second order benefits of agricultural improvements, more leisure, lower health costs, increased sense of well-being, and improved family planning. However, the second-order benefits could be achieved only if one or more of the following complementary conditions were met:

1. The increased labor availability is utilized.

2. Labor was previously a development constraint.

3. Land is available.

4. Complementary resources, such as farm credit, are available.

5. Farmers are made aware of opportunities.

6. Grade cattle are purchased.

7. Health, home economics, and family welfare advice are given.

8. Complementary sanitary facilities are installed.

In other words, water was a necessary, but not sufficient, condition for development. This helped to explain why the richer, high potential rural areas in Kenya were the most active in demanding and providing improved water facilities through self-help projects. According to Carruthers, they had the necessary complementary facilities to make water investment productive.

Carruthers suggested that it was better to regard water as only one important input for rapid rural development and to concentrate efforts upon assessing the local potential and the complementary inputs required to realize this potential. An area with few complementary facilities, in Carruthers' view, would give a lower return to water investment than another area with similar potential but greater complementary endowments. For instance, the economic gains from investing in water supplies would be greater in areas with all-weather tea roads than in areas with similar ecology but unimproved earth tracks. Carruthers added that the water planner should not be expected to make an integrated development plan for the entire area, but he should be able to list the necessary complementary facilities and to notify the responsible authorities of missing facilities and likely opportunities.

Development policies were also important to Carruthers. If a policy of growth at least cost was followed, high potential projects with existing infrastructure should be selected. If the opposite policy of compensating the backward areas was pursued, then the necessary complementary investments should be specified (Carruthers, 1973).

Similar views were expressed by Feacham et al. (1978) in their evaluation of the Lesotho rural water supply program. In discussing complementary inputs, however, the writers rejected the concept of "self-sustained growth" or "autonomous development" as well as the idea that water supply could function as a "lead sector" in rural development. They argued that water supplies must be just one component of an integrated rural development program if any "spin-off" benefits upon other sectors were to occur. With regard to benefits, Feacham et al. stressed the influence that economic and environmental circumstances had on the occurrence of project results. For example, labor shortages could be a constraining factor on agricultural production, but if it was not a constraint, the release of labor through improved water projects would be of little benefit to agriculture. Similarly, where relatively little fecal-oral disease was water borne, an improvement in water quality was unlikely to have much effect on health. Although many of these external circumstances were seen to be beyond the control of the planner, some could be modified in order achieve particular benefits.

Table 10 lists some of the necessary preconditions and complementary inputs Feacham et al. associated with the benefits of a rural water supply program. According to the writers, the achievement of benefits became more dependent on other factors as the benefits became more complex. The complex benefits of agricultural advance and economic diversity, therefore, were dependent upon more preconditions and complementary inputs than the simpler benefits of time saving and health improvements.

Overall, Feacham et al. found few empirical benefits in the Lesotho rural water supply program. As a result, they claimed that too much was expected from water supplies, but they nevertheless supported the continuation of water supply development programs. They did acknowledge that more benefits could have been achieved through better program design and improved complementary inputs. It is unfortunate, however, that these writers' findings with regard to the lack of empirical benefits are more widely cited today than their important insights into the crucial areas of hygiene and health relationships, village institutions, and project design. For various reasons - political, social, and environmental - rural water supply development in Lesotho is not characteristic of water supply development in other countries. Because of the

Aim or benefit	*Preconditions or complementary inputs*
Time-saving	New supply used in preference to old, and closer to dwellings than old, supply competently built and maintained
Health improvement	Hygiene changed to take advantage of improved supply; new supply must not create new health hazards
Labour redeployment	Economic opportunity in agriculture or industry
Agricultural advance	Any benefits from domestic water supply alone are very small compared with those from new markets or new technology such as large-scale irrigation
Economic diversity	Water must be one component in a growth point strategy, although growth points will normally be towns, not villages.

Table 10. Preconditions and Complementary Inputs for Water Supply Benefits (Feacham et al, 1978).

paucity of well designed field evaluations, the empirical portion of the Feacham et al. study has assumed a greater importance in water supply policy discussions than is warranted by the evidence.

Complementary inputs are only part of the overall supporting conditions necessary to maintain successful water and sanitation programs. If complementary conditions are the direct and indirect investments required to remove constraints or to provide additional assistance, then the remaining environmental, social, and institutional constraints are the existing conditions around which programs must be designed. These existing conditions define the environment within which programs and projects must operate. They include available resources, both material resources, such as water sources, supplies, equipment, and money, and institutional resources, such as village committees and government agencies. If these resources are deficient, complementary investments may be used to strengthen or otherwise modify them. In such cases, new induced conditions result, and the range of support conditions then can be defined as existing conditions, complementary investments, and induced conditions.

As an example of support conditions for successful water and sanitation programs, Kalbermatten et al. (1980b) listed both institutional requirements and community participation needs:

Institutional requirements -

1. A sector strategy supported by government.
2. Frequent reassessment of technologies.
3. A stable, autonomous institution with clear responsibilities.
4. A tariff policy that insures financial viability and encourages efficiency and equity.

5. Manpower development programs and career opportunities in the sector.

Community participation needs -

1. Unstructured interviews with community leaders and some users to identify user attitudes.
2. Design and testing of a questionnaire for structured interviews,
3. Structured interviews with a sample of households.
4. Presentation of feasible technologies to the community to determine willingness to pay.
5. Organization of construction.
6. Continued operation, maintenance, and monitoring activities.

For the most part, the institutional requirements are givens, (existing conditions) which the planner must accept in the early stages of program formulation and project identification. Complementary investments can be easily proposed for tariff policies and manpower development programs, but the other items are less amenable to specific investments at the program level. In the case of community participation, all of the listed items can be considered at the earliest stage.

In summary, complementary investments are part of the larger set of support conditions affecting water and sanitation programs. According to Feacham et al. (1978), these investments are part of a "chain of decision-making" leading to an integrated plan of rural development. In this chain, the writers considered the following sequence of decisions to be especially important in determining planning priorities:

1. The desired benefits of the program are stated.
2. Coordinated complementary measures are indicated.
3. Available local institutions are identified.

4. The appropriate technology is selected.

5. Project villages are chosen.

6. Administrative procedures are designed.

3.8 Summary of Preconditions

This chapter has shown that a wide variety of issues is important to successful project development. Since there is need to consider many of these issues during the process of project identification, it is useful to group them under the general term of "preconditions."

In general, preconditions include both the planned inputs and the expected outputs of the development process, as well as the existing socioeconomic conditions and supporting infrastructure. Recognition of the range of preconditions that can affect project success is an essential element in developing guidelines for both program formulation and project identification. The following is a summary of the preconditions emphasized in the development literature.

Recent work in the area of social analyses has provided many new insights into the development process. The identification and assessment of basic human needs is becoming increasingly important in policy formulation, especially among the international organizations. The World Bank, for example, currently emphasizes a core set of needs which include health, education, shelter, and water and sanitation (World Bank, 1980b). The primary operational effect of a basic needs policy is the allocation of resources to the poorer countries and to the poorer areas of these countries. To do this equitably, however, the development organizations must establish methods for measuring the extent of the needs.

Social analyses have resulted in a number of mechanisms for measuring developmental conditions. Indicators provide a rapid means of assessing the relative conditions of different countries or regions. Indicator variables have been developed for population growth, life expectancy, infant mortality, calorie and protein intake, literacy, school attendance, income, employment, agricultural production, land ownership, access to water supply, and many others. By giving each indicator variable an objective scale, more powerful quantitative measures can be developed which allow multi-variable comparisons of countries. The Physical Quality of Life Index (PQLI) which measures infant mortality, life expectancy, and literacy, is the best example of a procedure for assessing and ranking different areas on the basis of a number of key indicator variables (Morris, 1979). By their nature, indicator variables and indices are proxies for the more complex conditions they are intended to assess. Their main advantages are that they can be made as rigorous as measurement resources will allow and that they provide a systematic means of translating policies into operational guidelines.

Checklists are another mechanism for assessing developmental conditions. They do not provide a rigorous means of measurement, but by their unconstrained nature they can be used to ensure that most relevant issues are considered and to encourage the planner to look into issues that may be too complex to predict in advance. Checklists have become increasingly popular among most development organizations. The World Health Organization, for example, has developed an extensive checklist for assessing the social and economic potential for community education and participation in water and sanitation projects (Whyte, 1980). An equally extensive checklist for the technical and economic appraisal of water and sanitation projects has been used by the World Bank since 1978 (World Bank, 1978). Guidelines recently prepared for USAID have recommended the use of formal checksheets in project planning (Goff and Burke, 1980). In general, the literature shows no restrictions on the extent or application of checklists. Their usefulness, therefore, appears to be limited only by the amount of time and effort the planner wishes to devote to this form of analysis.

Methods of social soundness analyses generally attempt to incorporate the above mechanisms into an overall procedure for program or project assessment. Thus, the concepts of basic needs, indicator variables, indexing, and checklists are used to measure the necessary preconditions of motivation, local decision-making, and community participation. Where necessary, these mechanisms are also used to measure accessibility, utilization, and other direct consequences of water and sanitation projects.

The social soundness literature points out a number of conditions essential for project success. Elmendorf and Buckles (1978) stressed that true community participation had to be based on local practices and that water and sanitation problems had to be perceived by the community itself. Dajani (1978) emphasized that a willingness to pay for the system and an awareness of hygiene were crucial for system utilization, which in turn was a precondition for socioeconomic benefits. Self (1979) stated that benefits were dependent upon a package of complementary inputs consisting of hygiene education, sanitation, community involvement, and system maintenance. In his view, projects were more likely to succeed if the community was fully aware of system alternatives, benefits, tariffs, and implementation needs and fully participated in project planning, selection, training, and rate collection.

Socioeconomic status refers to the social and economic environment of a community. It influences the type and extent of water and sanitation projects the community can successfully adopt. Shuval et al. (1980) proposed a threshold-saturation model that illustrated the relationships between sanitation level, socioeconomic status (SES), and health status. Using indicator proxies of life expectancy for health status, adult literacy for socioeconomic status, and access to piped water for sanitation level, the writers argued that at low levels of SES, as well as high levels, single interventions of improved sanitation by themselves had little effect upon health. Although the threshold-saturation model has not been fully tested, it supports the view that there is an optimum mix of pre-existing socioeconomic conditions within which improvements in water supply and sanitation can lead to major improvements in health and other benefits.

The type of technology chosen for a project must be appropriate for the socioeconomic status of the community. Some of the important technological characteristics are system design, levels of service, costs, and maintenance needs. The concepts of system design and levels of service usually allow a ranking of water and sanitation improvements based upon the variables of water quantity, walking distance, cost, and methods of waste transport and disposal. According to White et al. (1972), the success of any community water design is dependent upon the users' choice and their perception of water quality, difficulties at the source, and social interactions during the water collecting process. In the choice of sanitation technology, Kalbermatten et al. (1980a) stressed the importance of climatic and site conditions, socio-cultural factors, and the institutional framework within which projects must function. Thus, the basic choice of technology must be appropriate to the existing socioeconomic, environmental, and institutional setting, but the ultimate success of any water or sanitation system probably will be dependent upon non-technical issues.

Preconditions also include a variety of complementary investments, conditions, and project outputs. Complementary investments may include associated components of a water and sanitation plan as well as components of a completely independent, but supportive, plan. Complementary conditions are the pre-existing institutional and behavioral conditions necessary to support a new intervention. And lastly, complementary project outputs are the project-induced changes in support conditions necessary to bring about the next stage of project impacts. Examples of complementary investments include maintenance training programs, market roads, and hygiene education, while complementary (or pre-existing) conditions include the availability of land, the existence of constraints on labor, and the knowledge of opportunities. Similarly, examples of complementary project outputs are released labor, improved labor quality, better water quality, greater supply reliability, and increased water consumption.

Both Carruthers (1973) and Feacham et al. (1978) stressed the complexity of complementary conditions and inputs. They called for water and sanitation to be part of an overall integrated rural development program rather than a single input. Carruthers urged that the water planner identify the needed complementary facilities. Feacham et al. recommended that the planner explicitly state the desired benefits and then follow a "chain of decision-making" involving the coordination of complementary measures, the identification of local institutions, and the selection of an appropriate technology as part of an integrated rural development plan.

3.9 Conclusions from the Literature on Preconditions

A review of the literature on preconditions for successful water and sanitation programs leads to the following general conclusions:

1. The use of social variables in investment analyses for water and sanitation projects is relatively new and still unproven. There is a need for assessment measures different than those used for technical or economic factors. Because of this lack of knowledge, it is not possible to develop a consistent measurement system for social variables at this time.
2. International development organizations are currently moving to a basic needs approach in program and project planning. This emphasizes the fact that need is a key precondition in program formulation and project identification.
3. There is a growing recognition of the importance of support programs in water and sanitation development. Current emphasis is on community participation, institutional development, training, and maintenance programs. Since most support programs are personnel oriented, whereas coverage programs tend to be capital intensive, there is a need to give greater consideration to social issues in program development.

4. There also is a growing recognition that the level of basic welfare or relative development is an important factor in a community's acceptance of a project and its capability to benefit from it. It is worthwhile, therefore, to establish measures of socioeconomic status in order to assist the selection of appropriate interventions.

5. Project interventions can vary widely in terms of technical sophistication, service levels, capital intensity, maintenance inputs, and costs. There is a need, therefore, to identify the range of technologies suited to the particular socioeconomic status of a community.

6. Various conditions are needed to support successful water and sanitation projects. Some are part of the basic environment (existing conditions); some are direct components of the water and sanitation plan or part of another, unrelated project (complementary investments); and others are anticipated short-term changes in support conditions resulting from project development (induced conditions). Since all of these conditions contribute to ultimate project success, it is essential to understand them and be able to identify them in practice.

7. Since all water and sanitation planning should be oriented towards specific objectives, the determination of project benefits should be part of program formulation and project identification. It is necessary, therefore, to predict the likely benefits of water and sanitation programs during these early stages of the planning process.

Chapter 4

ANALYTICAL FRAMEWORK

4.1 Purpose of Chapter

The empirical findings and theoretical concepts presented earlier are used in this chapter to develop an analytical framework for the assessment of preconditions in the area of water supply and sanitation. This framework is intended to lead the planner in a logical manner through the major issues that constitute the preconditions for successful programs and projects. Although not yet operational, the framework is basically a model for highlighting the extent of and the relationships between the various categories of preconditions. It should be used in the earliest stages of the planning process, namely, in program formulation and project identification.

The chapter begins with a review of the concept of preconditions and of the importance it has for water and sanitation planning. To assess preconditions effectively, however, the planner must understand the meaning of program "success," which is another way of saying the achievement of program objectives. A framework for assessing preconditions is then presented as follows: (1) the problem is identified; (2) the socioeconomic status of the community is determined; (3) a level of technology appropriate to the community is selected; (4) various supporting conditions for that technology are determined, and (5) the likely benefits of the overall intervention are predicted. Having gone through this procedure, the planner should be able to state whether the proposed program or project is likely to be successful.

In short, the main purpose of this chapter is to propose a general model encompassing the preconditions relevant to water and sanitation programs. This model will provide the basis for more detailed operational guidelines for program formulation and project identification.

4.2 The Role of Preconditions in Water Supply and Sanitation Planning

Preconditions comprise a broad range of attributes and constraints which influence the outcome of water and sanitation programs and projects. An understanding of preconditions and their relationships to program success can be a valuable tool in project planning, especially in initial project identification. High potential projects, for example, can be more readily identified, while those with otherwise-baffling constraints can be designed to achieve their maximum potential. Conversely, ignoring one or more key preconditions may doom a project to failure. As shown in the previous chapter, preconditions for successful water supply and sanitation programs include such issues as perceived problems and needs, various social and economic conditions, the receptivity of communities to project inputs, the need for supplementary investments, and finally realistic potential benefits.

Water and sanitation programs should not be imposed arbitrarily upon communities. The literature clearly shows that pre-conceived programs and projects can be stamped upon unwitting communities only at great peril: the peril of unsuitable design, unacceptable service, and eventual project failure. Nor can every program and its included projects be analyzed "from scratch" by teams of high-level professionals. Planning resources are limited and the costs of sophisticated inputs ensure that only a small number of programs and projects will eventually be implemented.

This paper is concerned with preconditions from the standpoint of the crucial role they play in program and project planning. It is important, therefore, to understand the interrelationships of preconditions in the planning process, to be able to identify them at the initial stages of this process, and to be able to use them to guide subsequent planning. The model of preconditions outlined in the remainder of this chapter is designed to provide a basis for each of these essential activities.

4.3 Definition of Successful Programs

The identification and use of preconditions in program planning is contingent upon the type of "success" desired in the subsequent program. Successful water and sanitation programs, simply stated, involve a set of activities that achieve the objectives for which they were planned. Although the immediate objective of water and sanitation interventions may be to improve the water supply and sanitation facilities in a community, the ultimate purpose is likely to be the achievement of variety of health, economic, and social benefits. The measurement of goal achievement is still in its infancy, however, and a determination of "successful" is not always straightforward and unambigious.

In many ways, it is easier to define successful water and sanitation programs by what they should not be. For example: such programs must work; they should not be inoperative nor provide a deteriorating level of service to their users. They must be used; they should not be ignored or by-passed by a large proportion of the community in preference to traditional water sources and sanitation facilities. Moreover, they normally involve the community; they should not have been implemented and operated in isolation from the active participation of the surrounding community. And finally, they must provide benefits; they cannot be simply a set of physical facilities that have no effects on individual behavior and ultimate community welfare. Successful water and sanitation programs usually include properly functioning physical systems, behavioral changes involving water usage and sanitation practices, and long-term health, economic and social impacts.

In short, successful water and sanitation programs represent technological, behavioral, and institutional changes leading to improvements in the health, economic, and social conditions of participating communities. Success, therefore, must be defined, not only in terms of direct program inputs and outputs, but also in terms of behavioral changes and ultimate project benefits. Preconditions are the base into which the seeds of successful programs must be planted and carefully nourished. In this manner, successful programs are defined not only by their final outcomes but also by the conditions in which they develop.

4.4 Model of Program Preconditions

To use the concept of preconditions in the identification of potentially successful programs and projects, a model is needed to guide the necessary decision-making. The process involves selective questioning, a search for answers, and gradual understanding. Each answer and each additional piece of information should tend to direct the inquiry along a course leading in time to an understanding of the requirements for a successful program. Although many types of models could be developed to guide the identification of preconditions, the characteristics of simplicity and applicability should be emphasized if the recommended model is to be actually used in the field. Where possible, each step should be accompanied by a series of questions or checklists to insure that the key aspects are addressed.

There are five general categories of preconditions that form the basis of successful program formulation and project identification. In order of appearance, these categories are:

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

A graphic model of the five categories of preconditions is shown in Figure 10.

4.5 Types of Preconditions

4.5.1 Problems and Needs

Before all else, the planning of community water supply and sanitation programs must begin with a problem. Thus, the identification of problems, the assessment of needs, and the verification that there exists a desire for change are essential preconditions for initiating any further actions.

Problems, in general, must be defined in terms of relevant development goals and objectives. In water and sanitation development, the goals of the national government, the affected communities, and USAID are all relevant in the establishment of programs. These goals, however, are rarely similar in application. National goals tend to be concerned with the contribtuion of the separate parts to the whole; community goals are focused on local needs, and USAID goals are tied to the support of U.S. foreign assistance policies. To the extent that these different institutions maintain dissimilar goals for water and sanitation development, the potential range of successful programs will be correspondingly reduced. In such cases, the planner must work harder to identify programs acceptable to all parties.

Once problems have been identified, the assessment of needs immediately follows. For example, the problem may be polluted water supplies; the corresponding need will be for higher quality water. Needs refer to

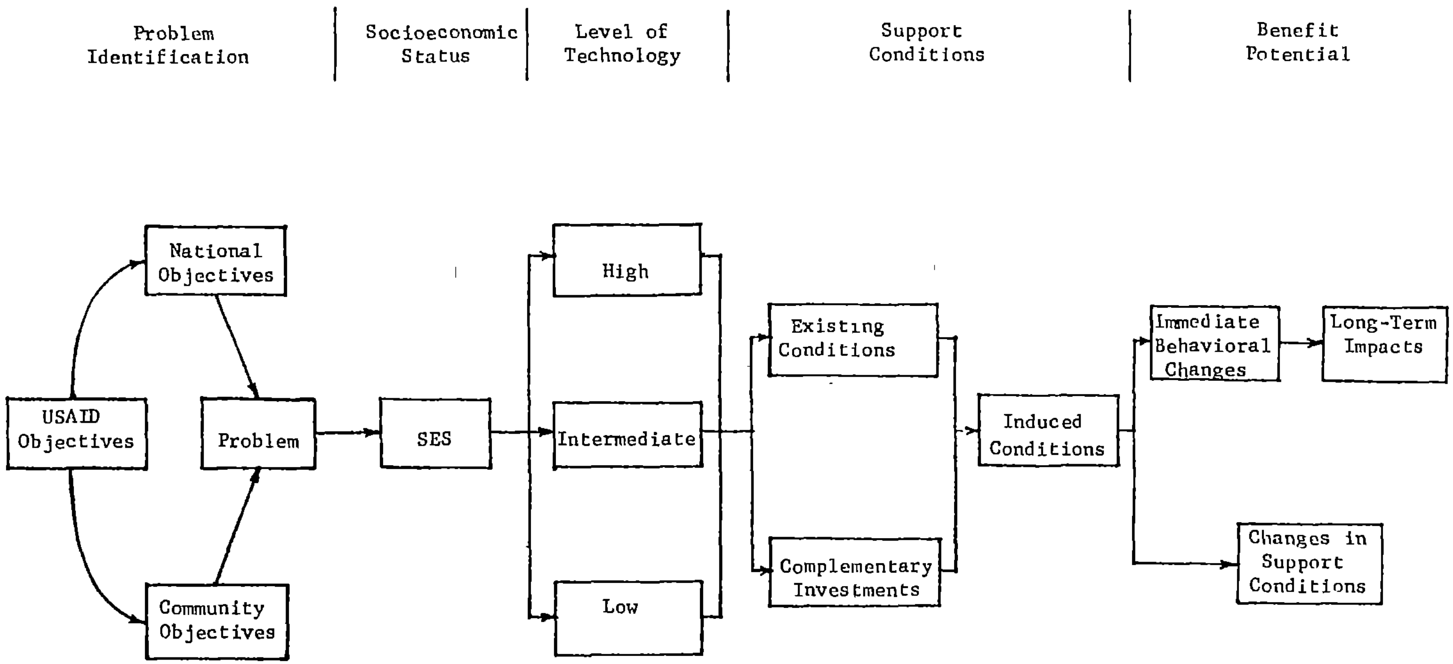

Figure 10. Model of Social and Economic Preconditions in Program Development

the desired relief or change but not necessarily to the means of solution. Thus, whether higher quality water should be provided through treatment of existing supplies or the provision of new supplies cannot be decided at this point. Such decisions can be properly made only after considering various intervention preconditions.

A final aspect of needs involves the degree to which there is a desire within the national government, the community, and USAID to improve the water and sanitation problem. As before, the views of all three institutions are important, but those of the affected communities carry the greatest weight. Communities anxious for improvement and impatient with delay are a favorable precondition for ultimate project success.

4.5.2 Socioeconomic Status

Problems and their corresponding solutions can be defined accurately only within the context of the communities in which they occur. What to one community is a severe shortage of water is to another an abundant surplus. Thus, before any attempts are made at formulating solutions, it is necessary to identify the background conditions of the communities and the people who live in them. Ideally, a thorough analysis of these conditions should be made to provide a baseline against which all possible project interventions could be assessed. In practice, it is more reasonable to look for a minimum core of easily measurable indicators having strong links to a smaller, but highly likely, set of project interventions and expected benefits.

This core set of indicators should show the social and economic attributes of the populations on the one hand and the status of the existing water and sanitation facilities on the other. The two best examples of social and economic indicators are the poverty performance indicators keyed to USAID development goals, shown in Table 7, and the Physical Quality of Life Index (PQLI), illustrated in Table 8. The basic problem with all of these social and economic indicators, however, is the lack of data at the program and project level. Where data exist, they normally refer to the entire country and not to specific communities. Occasionally, statistics for one or more indicators can be found in earlier studies, project reports, and so forth. Unfortunately, such statistics are rarely available for all potential target communities, which makes comparisons and rankings of all communities within a program difficult to accomplish.

Some of the social and economic indicators in the above examples can be crudely estimated in the field through various combinations of informal sampling, interviews, and observation. These include percent of population under age 15, calorie intakes, school enrollment ratios, adult literacy rates, and employment ratios. The adult literacy index in the PQLI is the easiest of the three indices to estimate. Moreover, since adults are the active members of the community, adult literacy may be the most relevant single indicator of the capacity of a community to benefit from a water and sanitation project.

To strengthen these social and economic indicators, it may be necessary to develop a new social wealth index that can be quickly constructed on the basis of field visits and what is likely to be minimally available data. The aspects of this index should be housing, farming equipment, personal transport, community institutions, and health status. Housing could include quality of buildings, types of furnishings, and room occupancy rates. Farming equipment could include the tools and equipment available to and used by farmers. Personal transport, as measured by motor vehicles, boats, bicycles, donkeys, etc., refers to the opportunities for physical mobility under the control of the people themselves. Community institutions, such as clubs, committees, and self-help groups, are a measure of the social mobility of the populations. Health is a complex aspect and difficult to define, but crude operational field measures probably can be developed for diarrhea, skin diseases, and basic nutrition.

The second component of the desired core set of indicators is the status of the existing water and sanitation facilities. Experience has shown that the dimensions of quantity, quality, accessibility, and reliability can be used to adequately describe water and sanitation conditions. These dimensions could be applied in the form of numerical scales, such as number of gallons per capita per day or number of minutes spent collecting water per day, or in ordinal categories, such as high, medium, and low ratings for per capita daily water use and efforts expended in collecting water. In the event ordinal categories are chosen to rate the four dimensions, there should be a quantitative basis to which observation, measurement, and other sources of information are compared.

Thus, overall socioeconomic status is the baseline picture of the targeted community. For practical purposes, it should be a composite of social and economic indicators drawn from poverty performance indicators, the PQLI, and a crude social wealth index. In addition, it reflects the status of existing water and sanitation facilities in terms of the dimensions of accessibility, quantity, quality, and reliability. since socioeconomic status is a baseline of many variables, it should not be reduced to a single index value but should be retained in a condensed, multi-variable form for use in selecting the appropriate levels of technology.

4.5.3 Level of Technology

The appropriate level of technology for a water and sanitation intervention must be based upon the existing problems and the socioeconomic background of the affected community. While technology in a strict sense is an input, the appropriate level of technology is defined by the characteristics of the community. Both the type of problem and the socio-economic status of the community are preconditions for the choice of an appropriate range of technologies. This range will be greater or smaller depending upon the support conditions present in the community. At this point in the assessment, however, it should be possible to define a range of potentially successful technologies, thereby eliminating those technical interventions which either do not adequately solve the water and sanitation problems or are not suitable for the so cial and economic characteristics of the affected populations.

There are many ways to define and characterize water and sanitation interventions (White et al., 1972; Kalbermatten et al., 1980). Aspects of service levels, design sophistication, costs, maintenance requirements, and ultimate benefits could be used for this purpose. What is needed, however, is a simple hierarchy of technologies that can be quickly applied during field reconnaissance and yet are broadly inclusive to allow considerable design flexibility at later stages. Just as simple indicators and indices can be developed for socioeconomic conditions, so also can broad indices be established for technologies.

In water and sanitation interventions, the concept of level of service provides a simple, yet reasonably inclusive, measure of levels of technologies. Water systems can be classified into the following levels:

Level 1: Non-piped water systems (low technology)
- wells with or without handpumps, reservoirs, ponds

Level 2: Piped-communal water systems (medium technology)
- water piped to communal taps in the village

Level 3: Piped-house connections (high technology)
- water piped into individual houses

These classifications also could be termed low, medium, and high levels of technology. They generally assume increasing inputs of cost, design sophistication, and maintenance requirements, as well as increasing outputs of water delivered to the users, overall time savings, and ultimate health, social, and economic benefits. Another way of stating the above is that increasing levels of service are related to increases in the dimensions of quantity and accessibility. Because of increasing technical sophistication, however, reliability usually decreases. One the other hand, water quality bears no direct relationship to the above hierarchy since it is often as much a function of natural water source conditions as it is of design inputs.

A similar hierarchy can be established for sanitation facilities, as follows:

Level 1: Basic pit latrines (low technology)

Level 2: Water seal (pour flush) latrines with on-site disposal (medium technology)

Level 3: Flush toilets with off-site disposal (high technology)

At the low end of the scale can be placed basic pit latrines; at the intermediate level are variants of water seal latrines with on-site disposal, and at the top end are flush toilets with off-site disposal. Again, each higher level reflects increasing costs, design sophistication, and maintenance requirements. And similarly, the hierarchy generally corresponds to increasing ultimate benefits for the users.

The relationships between socioeconomic status and levels of technology are important from two perspectives. In one sense, the potential technologies must be within the absorptive capacity of the community. The potential interventions, therefore, should be identified on the basis of existing social and economic conditions. But since such interventions are usually intended to change behavioral patterns, which in turn are prerequisites for the achievement of ultimate project benefits, some of the initial social and economic conditions also will be changed. Therefore, the second view is that the choice of technology is dependent upon socioeconomic status and socioeconomic status, in turn, is influenced by the consequent technological choices.

4.5.4 Support Conditions

Support conditions include the technical, institutional, administrative, and infrastructural factors needed to nourish and sustain a program or project. During both the implementation and operational phases, water and sanitation projects require support geared to the range of technologies tentatively chosen earlier. For example, a deep well drilling project will require roads capable of handling heavy vehicles, whereas a spring capping project in a mountainous area may be sufficiently accessible by footpaths. The selection of an appropriate technology, therefore, is not only dependent upon the water and sanitation need and the socioeconomic background of the affected community but also upon the types of support conditions that are available to maintain that level. In this manner, the level of technology is determined primarily by socioeconomic status, which is a measure of community acceptability, and by support conditions, which is a measure of resource availability.

Support conditions can be classified into three main groups. The first consists of the existing conditions, which can be viewed as an initial baseline of available resources. The second group includes the additional inputs and complementary investments necessary to generate specific supporting conditions. And lastly, the third group contains anticipated short-term changes in support conditions likely to result from project development complementary investments.

The existing conditions consist of the available human, institutional, and material resoures essential for project support. For water and sanitation investments, this may include, among other things, skilled and unskilled manpower required for project construction and operation, organizations capable of encouraging community support and accepting responsibility for the administration of completed projects, and community residents eager for improved water and sanitation facilities. Other important resources include local willingness to contribute time and money to the project, the availability of finance, materials, and tools, and the presence of essential infrastructure, such as roads, government supply offices, and electricity. In Kenya, for example, the local communities were generally unable to support the level of technology used in the national rural water supply program (Dworkin, 1980). A key aspect of existing conditions is the basic environmental suitability of the project site; in other words, can the selected level of technology be supported by existing groundwater conditions, soil characteristics, rainfall amounts, etc?

Complementary investments refer to any inputs, other than the basic water and sanitation facilities themselves, necessary to insure project success. Such investments may be directed at modifying the socio-economic status of the community, but their primary purpose is to correct the resource deficiencies found in the existing support conditions. In general, complementary inputs can be funded by two different sources. They can be an integral part of the water and sanitation project, such as a health education component or a pump maintenance training course, or they can be part of a separate development effort, such as the construction of a new access road or the establishment of a water-using industry. The lack of key complementary inputs can be devastating. In Tunesia, for example, a program for the renovation of 300 existing wells and springs was marked by the absence of local participation as well as ineffective maintenance and insufficient health education. As a result, the water supplies were not consistently potable, water use patterns did not change, and health benefits were minimal (Bigelow and Chiles, 1980).

To the extent that ocmplementary inputs are associated with development activities beyond the control of the water and sanitation project, there will be increased problems of planning and coordination. Some of the more common complementary investments in water and sanitation programs are health and hygiene education, manpower development, community institutional development, health and water quality surveillance, and operation and maintenance (WHO, 1980).

The third group of support conditions consists of the changes that are expected to occur in the initial existing conditions as a result of the project or any of its complementary investments. These changes may be thought of as induced conditions. They are the immediate, short-term reactions induced in support conditions by activities associated with the water and sanitation project. For example, a potential project may be constrained by the lack of skilled artisans in the community. Complementary investments involving training in plumbing, masonry, and carpentry can eliminate the manpower constraint and thereby change the resources available to the project. In other words, the project itself will induce new support conditions necessary to carry out the plan. Because these changes are essential to project success, the planner must be able to anticipate them in the overall review of preconditions.

4.5.5 Benefit Potential

The ultimate step in the assessment of preconditions is the prediction of benefits. This should be preceded by a review of the initial needs of the community, its socioeconomic status, the likely level of technology to be chosen, and the degree to which essential support conditions will be present. The planner then should determine the short and long-term consequences of the water and sanitation intervention, which was initially conceived during the consideration of levels of technology and further defined during the assessment of support conditions. In reality, the process will rarely be this simple, since the main benefits probably will have already been considered during the initial stages of problem identification.

Surprisingly, benefit estimation is rarely carried out in a detailed manner by project planners. Because of the difficulty of linking project inputs with eventual project benefits, planners are more likely to justify projects on the basis of input relationships, such as costs, number of projects built, amount of water produced, and so forth. Occasionally, lip service is given to basic development goals, such as improved health and greater social well-being, but rarely are these "benefits" stated in any but the most general terms.

When projects are planned primarily on the basis of inputs, rather than both inputs and outputs, their eventual achievements tend to be assessed in terms of input measures. This, of course, is a fundamental weakness in project planning. Water and sanitation projects are not implemented primarily for the purpose of laying pipes or pouring concrete or even producing clean water. They are built to improve people's health, to relieve them of the debilitating effects of excessive water hauling, and to improve the overall quality of life. Without a clear sense of the type and magnitude of benefits a given project can produce, the planner is unable to say with confidence that a proposed project has a high potential for success.

Inputs, of course, should lead to outputs. Unfortunately, the procedures for the prediction of ultimate impacts are still imprecise and subject to a great deal of uncertainty. As discussed in Chapter 2, our understanding of project consequences is greatest when the initial inputs are closely related to outputs, but it becomes progressively weaker as the linkages lead away to second and third order consequences. The approach, therefore, is to concentrate assessment efforts on those consequences directly linked to project inputs and to make cautious estimates about the less direct and more distant outcomes. The impact assessment model shown earlier in Figure 5 should prove useful in identifying project consequences relevant to benefit estimation. Although the ultimate system impacts are the most important consequences, the most readily measurable, and therefore most relevant, outcomes are found at the system operation and system performance levels.

There are two groups of potential benefits that should be assessed. The first consists of the immediate behavioral and institutional changes associated with the project plus the long-term impacts that are the primary objectives of project development. The second group consists of the long-term changes in support conditions that add to the stock of available resources for future development efforts.

Project impacts were reviewed in Chapter 2 and summarized in Figure 5. It is assumed that the initial dimensions of accessibility, quantity, quality, and reliability, which are the measures of system operation, were assessed at the time that the socioeconomic status of the community was determined. In any event, these dimensions can be viewed as technical inputs into the development process; they are not the benefits of the process. It is the short-term behavioral and institutional changes, which are measures of system performance, that need to be estimated. These changes include the likely use of water and sanitation facilities, the degree of adoption of improved hygiene practices, and the extent of community support for system operation and maintenance.

The true benefits of the project, however, are the anticipated health, social well-being, economic, and environmental quality changes which are measures of ultimate system impacts. Health impacts include reductions in the endemicity of water and sanitation-related diseases and changes in the geographical pattern of these diseases. Social well-being impacts include greater convenience and more leisure time, improved social status, and a greater willingness to undertake other improvement projects. The economic impacts resulting from water and sanitation interventions may consist of lower direct monetary costs for water supply, decreased health care costs, and greater economic outputs resulting from improved health and time savings. Environmental quality impacts include, among other things, improved drainage, groundwater protection, and vector control.

The second group of potential benefits are the long-term changes induced in support conditions. When the implementation of water and sanitation program leads to the training of a cadre of skilled artisans or the formation of community-based water committees, the total stock of development resources available for other projects is increased. These resources have a broader value beyond their intended use in project construction or operation. Although the strengthening of these supporting resources is not likely to be the primary objective of water and sanitation programs, the resulting changes are nonetheless beneficial towards the achievement of overall development goals and, therefore, should be included in the assessment of preconditions. Some of the long-term improvements in support conditions that may occur are an increase in trained manpower, the growth of experienced community institutions, and an acceptance of community participation as a means of achieving local goals.

4.6 Summary of Analytical Framework

Preconditions include all of the essential issues that should be considered in the identification of high potential projects or in the initial planning of comprehensive programs for water and sanitation. Successful programs are the result of successful individual projects. Therefore, the process of assessing preconditions applies primarily to project planning, although many of the concepts are equally useful in program planning.

Successful programs and projects are activities that achieve their intended objectives. Since the true benefits of water and sanitation projects are the long-term health, social well-being, economic, and environmental quality impacts, project planning should take these impacts into account when objectives are established. To achieve these benefits, projects must reflect levels of technology that are consistent with the socioeconomic conditions of the affected communities and are capable of being supported by available resources.

This study tends to classify preconditions into neat hierarchical categories, whereby the assessment of one group leads logically to the next. In theory, each category of preconditions should be reviewed in its proper sequence and the determination of the appropriate program or project should occur in well-defined steps. In practice, however, a planner will probably simultaneously consider all categories of preconditions and is likely to begin formulating potential solutions at the very beginning of the planning process. The more experienced the planner is with program formulation and project identification the more likely is he to deviate from a formal, yet simplified, model to a more informal, but inherently more complex, one. The model presented in this study is intended basically for the inexperienced planner and for the planner seeking greater insight into the nature and extent of preconditions. Further refinements, as well as operational details, can be best come from the actual experience of planners in applying this mode in the field.

In summary, the assessment of preconditions involves a process of decision-making in a number of key areas. In effect, these areas cover many of the topics included in the formal planning process but at a very preliminary level of detail. The main conclusion of this investigation is that there is no "quick fix" to the identification of potentially successful projects. There is no simple set of indicators that can be used in all situations and under all circumstances. The consequence of this conclusion is that the planner who wishes to be best prepared to undertake project identification is one who thoroughly understands the concepts of preconditions and the process by which they shape project success.

There are five major areas of preconditions and within each are numerous sub-categories of relevant issues. In summary, the areas are the following:

1. Problems and Needs
   - water and sanitation problems
   - corresponding community needs
   - development objectives
     * community
     * national government
     * USAID

2. Socioeconomic Status
   - socioeconomic conditions of the target populations
   - status of existing water and sanitation facilities

3. Level of Technology
   - level of service of water and sanitation
     * high
     * intermediate
     * low

4. Support Conditions
   - existing conditions
   - complementary inputs
   - induced conditions

5. Benefit Potential
   - intended outputs
     * behavioral and institutional changes
     * ultimate system impacts
   - long-term changes in support conditions

Chapter 5

CONCLUSIONS

5.1 Purpose of Chapter

Putting a general model of basically theoretical concepts into practice is not an easy task. In the case of preconditions, the framework proposed in the previous chapter may appear to be formidable to the inexperienced planner. The model contains more issues, and many of a diverse nature, than are normally considered in the early stages of water and sanitation planning.

To be a successful aid in future planning, the model must be translated into operational guidelines for use in the field. Since the approach suggested by this model is new, only the rough outlines of field procedures can be determined at this point. This model needs to be field tested, and through a general process of monitoring, revision, and even trial and error, the procedures will gradually improve over time. Without field testing, however, any model for the assessment of preconditions for successful water and sanitation interventions will remain only an academic exercise. There is very little accumulated experience on using preconditions for program planning in a comprehensive manner. The guidelines suggested here should be viewed as a first step subject to further refining and field testing.

The chapter opens with a discussion of the relative importance of different preconditions. All five of the general categories are equally important, but a few key preconditions within these categories should be emphasized. The chapter then presents suggested guidelines for the assessment of preconditions for, first, program formulation and, second, project identification. The essential similarities of these two approaches are stressed, although different measures are utilized in their application. The chapter and the report conclude with recommendations for future investigations into the concept of preconditions.

5.2 Relative Importance of Preconditions

It would be very useful if the five categories of preconditions shown in Figure 10 could be ranked according to their order of importance. The most important category then could be addressed first and, if resources permitted, the others could be assessed in their turn. This approach, however, is not possible because the five categories of preconditions are not alternatives to each other but rather sequential steps leading to the overall conceptualization of successful water and sanitation programs and projects. This model of preconditions is not merely a method of assessing the socioeconomic preconditions of an already existing water and sanitation proposal, it is a general guideline for the process of actually formulating the proposal. Each step in this process is important, since the decisions made in each category influence the choices appropriate to subsequent categories.

For any given proposal, it is possible to identify key preconditions within each category. In the category of level of technology, for example, a proposal for a piped water system with delivery via communal standposts should be assessed in terms of population density, walking distances, and alternative sources of water. The water system must have sufficient users to justify its existence in that community and the choice of technology it represents. Moreover, the technical sophistication of the system should be within the general understanding and level of expectation of the users. Otherwise, they are not likely to accept it and use it properly. The precondition of system acceptability should have been assessed as part of the socioeconomic status of the community. Other key preconditions for this proposal could be similarly identified. The number of such preconditions and the amount of detail required of each would depend upon the importance of the overall proposal and resources available for the assessment.

For purposes of these guidelines, it will be assumed that a relatively quick assessment of preconditions is needed. The planner should be prepared to use only two or three measures in each category of preconditions. The type of measures employed will depend upon the need for water and sanitation and the type of proposed intervention that results. These measures should be selected as needed from a larger, more inclusive list of potential preconditions.

A few general relationships regarding the choice of preconditions for specific situations can be highlighted:

1. Problem Identification

   (a) Water and sanitation problems that are mutually recognized by the national government, the local community, and USAID should have highest priority.

   (b) Water and sanitation needs should lead to the eventual solution.

   (c) The above needs should be "felt" and expressed by the affected population.

2. Socioeconomic Status

   (a) Demographic statistics are more important in densely populated communities than in sparsely populated ones.

(b) A social wealth index is useful in assessing both the technological sophistication of the community and its ability to pay for water and sanitation improvements.

(c) The status of existing water and sanitation facilities, as measured by accessibility, quantity, quality, and reliability, is important for all types of proposed facilities.

3. Level of Technology

(a) For sanitation systems, increasing level of service generally implies higher costs, greater design sophistication, greater maintenance needs, lower reliability, and more ultimate health, social, and economic benefits.

(b) For water supply systems, increasing level of service generally implies all of the above factors plus greater time savings.

(c) High levels of technology are generally more acceptable in communities with high socioeconomic status.

4. Support Conditions

(a) Support conditions become more essential as water and sanitation systems become more sophisticated.

(b) The key aspects of existing conditions are the availability of project inputs (labor, equipment, materials, finance), community organizations, community concern, development infrastructure (roads, schools, communications), and environmental conditions (rainfall, groundwater, soils).

(c) There will be a need for complementary investments in water and sanitation projects to the extent that existing conditions are unable to properly support the chosen technology.

(d) Induced conditions will generally occur faster in infrastructural factors, such as roads, workshops, and fuel supplies, and slower in human resource factors, such as manpower training and organizational development.

5. Benefit Potential

(a) Priority should be given to predicting short-term behavioral and institutional changes.

(b) For the prediction of health benefits, the most important behavioral changes involve water use and sanitation practices, while the most important institutional changes involve community-based organizations and maintenance programs.

(c) Long-term health, social well-being, economic, and environmental quality impacts should be related to initial program needs and should logically follow the occurrence of short-term behavioral and institutional changes; however, no attempts should be made to quantitatively predict these impacts.

(d) In general, the most important changes in support conditions are those involving personnel skills, local institutions, and community motivation.

5.3 Recommended Guidelines for Social and Economic Preconditions

5.3.1 Program Formulation

Water and sanitation programs, as defined in this study, are related capital works activities having common goals and occurring over a wide geographical area. Program formulation is the initial planning stage in the development of these activities. In general, water and sanitation programs are formulated before individual projects sites are selected. One of the main functions of programs is to define the constraints and conditions under which these projects are designed.

From the standpoint of program success, water and sanitation programs must serve a need and must be sustained. The most important characteristics of proposed programs, therefore, are that they directly contribute to national objectives and that they be capable of being supported by national and regional institutions. The preconditions guiding program formulation, therefore, should lead to a clear assessment of the relationship of the program to national objectives and indicate the extent to which institutional support will be available.

Ideally, preconditions for successful water and sanitation programs should be determined for each individual country. General criteria for program planning and assessment, however, are unlikely to be universally applicable since much of program success, as discussed earlier, is measured in terms of specific goals and objectives. With this in mind, the recommended guidelines presented here are an attempt to illustrate some key measures and show how they might be applied. The final set of measures, however, must be established on the basis of the prevailing conditions in a specific country.

Problems and Needs

1. Identify current USAID development objectives. A tentative list may include:

   (a) Promote technical assistance, not capital transfers.

   (b) Direct assistance to key target groups: the rural poor and women. These groups should be involved in decision making.

   (c) Promote self-help efforts of both individuals, communities, and institutions. Require significant local contributions of money, materials, and labor.

   (d) Emphasize technology transfer, especially appropriate technology, but introduce advanced U.S. technology where support conditions warrant.

2. Identify the development objectives of the host government. Review their current development strategies and plans.

3. Review the water and sanitation problems identified by government, as well as those identified by other creditable institutions.

4. Identify a core set of water and sanitation needs that are common to both USAID and national government development objectives.

Socioeconomic Status

1. Determine the most relevant national poverty status indicators, as shown in Table 6. Compare these indicators with current USAID targets and with other nearby countries.

2. Determine the most relevant national development performance indicators, as shown in Table 7. If possible, compare these indicators with those of other countries at the same per capita GNP level.

3. Determine the Physical Quality of Life Index for the country and compare it to other countries in the region.

4. Use the above indicators to determine socioeconomic strengths and weaknesses in the program area.

Level of Technology

1. Survey the program area for examples of successful water and sanitation technologies. It is rarely necessary to introduce radically different levels of technology.

2. Identify water and sanitation systems preferred by people in the program area.

3. Define a hierarchy of socially feasible technologies. Use level of service as a means of establishing the hierarchies.

4. Make preliminary cost estimates of each different technology in the above hierarchy.

Support Conditions

1. Identify the existing conditions and available program resources necessary to support the selected technologies. These may include:

   (a) National and regional institutions.

   (b) Technical, managerial, and skilled manpower.

   (c) Equipment, supplies, materials, and money - both domestic and available from foreign sources.

   (d) Infrastructure, such as access roads, government supply offices, and power and fuel supplies.

   (e) Environmental suitability, with particular reference to water sources, soil characteristics, groundwater quality, seasonal temperature variations, rainfall frequencies, etc.

2. Determine the major complementary investments needed to correct any resource deficiencies noted above. Identify whether these investments can be made part of the proposed water and sanitation program or whether they must be part of a separate program. Indicate whether any essential complementary invest-

ments can be found in current or proposed separate programs. Complementary investments within water and sanitation programs often include health education and operator training, while those in separate programs often include general training and infrastructure development.

3. Predict the induced changes that will occur in the resource base (No. 1 above) as a result of the program or any of its complementary investments. These changes may include more skilled manpower, strengthened national institutions, and new infrastructure.

Benefit Potential

1. Estimate the short-term behavioral and institutional changes that will occur. (Be sure to indicate what is likely, not what is desired.) Be as specific as possible in terms of total program population.

   (a) Behavioral changes may include greater water usage, modified latrine usage, new personal hygiene practices, participation in community-wide water and sanitation activities, etc.

   (b) Institutional changes may include the formation of water committees, acceptance of maintenance responsibilities, collection of water rates, etc.

2. Qualitatively estimate the long-term health, social well-being, economic, and environmental quality impacts. Show that these impacts are part of USAID and national government development objectives.

3. Estimate the likely long-term changes in support conditions. These may include the areas of trained manpower and national and regional institutions. Indicate which areas might qualify for other development inputs, such as health centers, schools, and markets, as a result of new water and sanitation facilities.

5.3.2 Project Identification

For the purposes of this report, water and sanitation projects are site-specific capital works activities contained within broader water and sanitation programs. Project identification is the process of selecting sites where water and sanitation interventions are needed and determining the general nature and scope of the interventions. In general, projects are identified within the context of existing programs.

As in the case of programs, project success is the result of fulfilling a need and receiving sufficient support. Such projects must both satisfy community needs and contribute to program success. In addition, they must be capable of obtaining the necessary human, material, and institutional support to fulfill these needs. The preconditions selected for project identification should clearly define the relationship of the project to the community and the program and show the extent to which the necessary support will be available.

The following general guidelines are provided as an example of the use of preconditions in project identification. Final details for field applications should be developed on the basis of specific programs.

Problems and Needs

1. Identify the current problems and needs of the community. This may be done in the following manner:

   (a) Define the range of relevant water and sanitation problems.

   (b) Estimate the relative urgency of the various problems.

   (c) Collect sufficient information to accurately define the major problems and their corresponding needs. This information may be drawn from statistics, meetings, reports and files, statements of officials, statements of villagers, and/or personal observation.

2. Define an objective for dealing with the problems that is consistent with community preferences, host government goals, and USAID policies.

Socioeconomic Status

1. Develop a social wealth index based upon housing, farming equipment, personal transport, community institutions, and health status. Use the index to assess the community and compare with national norms, if possible.

2. Develop a water supply and sanitation index based upon the dimensions of accessibility, quantity, quality, and reliability. Use the index to assess the water and sanitation facilities in the community and compare with national norms, if possible.

Level of Technology

1. Identify successful examples of water and sanitation technologies in the community.

2. Identify water and sanitation systems preferred by people in the community.

3. Select appropriate technologies from the range of socially feasible technologies developed at the program level.

Support Conditions

1. Identify the existing conditions and available project resources in the community necessary to support the selected technologies. These may include:

   (a) Community institutions, such as a village council, water committee, or women's club.

   (b) Manpower - both skilled and unskilled.

   (c) Local contributions in the form of tools, building materials, labor, and money.

   (d) Community infrastructure, such as roads, public buildings, health services, electricity supply, etc.

   (e) Environmental suitability, with particular reference to water sources, soil characteristics, groundwater quality, seasonal temperature variations, rainfall frequencies, etc.

2. Determine the major complementary investments needed to correct any resource deficiencies noted above. Identify whether these investments can be made part of the proposed project or whether they must be part of a separate development activity. Indicate whether any essential complementary investment can be found in any current or proposed separate activities. Complementary investments within water and sanitation projects often

include health education and operator training, while those in separate development activities often include general technical training and infrastructure development.

3. Predict the induced changes that will occur in the resource base (No. 1 above) as a result of the project or any of its complementary investments. These changes may include more skilled manpower, strengthened community institutions, and new infrastructure.

Benefit Potential

1. Estimate the short-term behavioral and institutional changes that will occur. (Be sure to indicate what is likely, not what is desired.) Be as specific as possible.

   (a) Behavioral changes may include greater water usage, modified latrine usage, new personal hygiene practices, participation in community-wide water and sanitation activities, etc.

   (b) Institutional changes may include the formation of a water committee, acceptance of maintenance responsibilities, collection of water rates, etc.

2. Qualitatively estimate the long-term health, social well-being, economic, and environmental quality impacts. Show that these impacts are within the project objective defined in part (2) of Problems and Needs.

3. Estimate the likely long-term changes in support conditions. These may include improvements in the areas of trained manpower, community institutions, local willingness to participate in other development activities, and infrastructure development.

5.4 Recommendations for Future Studies

In one sense, a study such as this is never completed. There will always be issues that warrant further investigation. The immense complexity of development interactions and human responses ensures that no single study can do more than define the barest outline of a model for using preconditions in program and project planning.

The task remaining would appear to be overwhelming except for the essential fact that the model developed in this report is intended to be used in actual planning situations. It is neither a research tool nor an academic analysis. It is intended to be used by planners in the earliest stages of water and sanitation development. To the extent that the model assists them in the twin tasks of program formulation and project identification, it will be a success and will merit further refinement. Without direct application, however, the model will remain only as an interesting but somewhat obscure, set of abstract relationships.

Planning is a process of making interrelated choices. "To do an review" is the basic method by which planning procedures are developed. This applies equally to the model of preconditions presented here. Since it is intended for use in the field, it must be tested, modified, and refined on the basis of field experience.

This emphasis on field application is not meant to imply that the longstanding issues of appropriate technology and impact relationships, or even the newer questions of socioeconomic status and community motivation, are resolved. On the contrary, these issues will continue to be the focus of intense inquiry for many years to come. What is proposed here, however, is simply an empirical, or trial-and-error, approach to the further development of a practical planning tool.

There are no mandatory procedures for testing this model. The basic need is to attempt to apply it to a variety of program and project situations. The planning context for the initial applications of the model should involve relatively small and reasonably well-defined water and sanitation programs. As experience with the planning model grows, it can be applied to larger and more comprehensive health and rural development programs containing water and sanitation as one of several components.

Particular attention should be given to defining a core set of variables in each of the five main categories of preconditions. It is suggested that the recommended guidelines of section 5.3.1 be used as a starting point and then be expanded or otherwise modified as needed. The preconditions selected for any one country or program are likely to be different for other countries or programs. Flexibility, therefore, will be important especially in the first few planning efforts. After programs have been formulated, preconditions for project identification should be developed within the program context. Again, the recommended guidelines of 5.3.2 can be used as a starting point.

It is not possible at this time to state the optimal level of detail in individual preconditions. In general, quantitative measures may be best, but the natural desire for detailed quantifiation should be balanced against the need to provide the planner with a simple, straightforward decision-making process. Detailed measurements will undoubtedly be carried out during later feasibility studies. The primary need in program formulation and project identification is to develop a proposed water and sanitation intervention with a high probability of success, not to design the specific details of the intervention. Therefore, various methods of applying individual preconditions should be tried with a view towards providing the planner with a set of guidelines effective enough to merit their use and yet simple enough to encourage the planner to seriously apply them.

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