

**WATER-SUPPLY AND
WASTE-DISPOSAL MANAGEMENT:
IMPACT-EVALUATION GUIDELINES**

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FOREWORD

The large number of people unserved with water-supply, sanitation and refuse-disposal services in developing countries is partly a consequence of low priorities and limited funds assigned to these sectors in national development plans. While it is believed intuitively that water supply, sanitation and refuse disposal, alone or as part of a comprehensive intervention package, will reduce disease transmission and trigger developmental processes, it is difficult to demonstrate this causal relationship in practice. The inability to pinpoint and quantify most benefits from basic-service interventions is one of the reasons why these essential services have not received the attention they deserve.

Donor agencies, that finance a large proportion of the water-supply and waste-management projects in developing countries, have been recently forced to examine critically the allocation and use of development funds. Consequently, evaluation is increasingly incorporated as a component in the overall project cycle. Most evaluations are, however, confined to assessing the efficiency and effectiveness of the project intervention, and little attention is given to assessing its impact. Not much is, therefore, known about project-impact assessment.

If water supply and waste management are to be accorded high priority in national development strategies and corresponding sectoral investments are to be increased, a wide appreciation of the beneficial impacts of project interventions is essential. This report attempts to elucidate some of the issues involved in impact evaluation of water-supply and waste-management interventions and defines basic guidelines for designing impact-evaluation studies. Impact evaluation in the water-supply and waste-management sectors still remains more an art than a science. It is hoped that the issues identified in this report will stimulate discussion on the subject amongst professionals, increase awareness of the benefits of basic-service provision amongst policymakers and planners, and further understanding of this little-known subject.

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INTRODUCTION

Evaluation, as a science, has been developing rapidly over the past two decades. Evaluation in the water-supply, sanitation and refuse-management sector has made slow progress but is now being bolstered by the insistence of most donor agencies that evaluations be incorporated in all projects before funding. Furthermore, many governments are calling for evaluations of projects in these sectors, whether externally funded or not. This is primarily in response to questions being raised as to the effectiveness of governmental initiatives and their long-term success rates which have generally been disappointingly low.

It is surprising, in view of the hundreds of millions of dollars that are spent annually in this sector, that so little is known of the impacts of providing clean water, sanitation services and waste-disposal facilities. All but a few past evaluations have focused on health improvements, but studies have seldom yielded concrete results until recently. Efforts spearheaded by the London School of Tropical Medicine and Hygiene are only now providing quantified assessments of health impacts. However, very little effort has so far been focused on social, economic and development impacts.

The prospective evaluator is typically confronted by a myriad of questions, not the least of which are who will use the results, what is the most cost-effective way of extracting reliable data, and what will be the scope and focus of the evaluation. The evaluator must set out well-defined parameters to maximize the usefulness and reliability of the results. This report tries to clarify some of these issues, to provide a background to the evaluation process and to act as a guide for the evaluator in designing impact-evaluation studies. Each evaluation differs according to local conditions and needs, so that there is no blueprint to follow, and this report does not pretend to provide one.

These guidelines have been written for evaluators, project managers, economists and students working in the water-supply, sanitation and waste-management sector. It first presents the framework into which impact evaluation falls and then focuses on various aspects of impact evaluation itself - principles, constraints, design, planning, the evaluation team, field surveys, data-collection methods and measurement parameters. The vast majority of evaluations that are carried out today are short-term evaluations. Thus, greater attention is given to cross-sectional evaluations (i.e., measurements made at a single, common point in time) carried out over months than to longitudinal evaluations (i.e., similar measurements made at different stages over a period of time) requiring years and substantial financial backing to complete.

How to use these guidelines

This report has been written so that the reader does not have to go through it in its entirety before planning an evaluation. For example, the first chapter, covering the history of evaluation in this sector, is informative but not essential reading. There are several pointers within that chapter, however, that might prove useful, especially on the importance of planning evaluation early in the project cycle, so that meaningful baseline data are collected before the project starts, for analysis on its completion.

The second chapter describes the three different kinds of evaluation - efficiency, effectiveness and impact - and shows how they interrelate. It is essential to know what kind of evaluation is being undertaken and why: the three kinds differ significantly in objectives, methodology and eventual use. Although these guidelines are concerned primarily with impact evaluation, there is often a need to include certain elements of effectiveness evaluation in impact evaluation, in order to understand why impacts occur (or do not, as the case may be). The chapter also describes the various kinds of objectives (goals, purposes and outputs) and how they relate to the three kinds of evaluations. Definition of these levels of objectives is always essential for effective project planning and, naturally, evaluation planning as well.

The principles of evaluation, the various subjects of impact evaluation and preconditions for evaluation are set out in the third chapter. There are many sources of error and bias which are bound to affect the evaluation, if the planner fails to recognize and take steps to avoid them. This chapter also describes various kinds of experimental designs that can be used in setting out an evaluation. Unfortunately, in most projects, there is no pre-project evaluation planning and, therefore, no baseline-data collection. The lack of baseline data prevents the conducting of longitudinal evaluations and confines most evaluation efforts to the cross-sectional design.

In the fourth chapter, a rural water-supply and sanitation project is taken as an example to illustrate how an evaluation is carried out. Careful selection of the evaluation team - the senior professionals as well as the interviewers and support staff - is crucial to the success of evaluation. This chapter describes what to look for in developing survey protocol, training interviewers, planning the fieldwork and providing support for field teams.

The fifth chapter covers the question of what data should be collected in the field and how measurements can best be made. Choosing what parameters to measure largely determines how effectively resources

will be used and how efficient the evaluation will be in pinpointing impacts. The choice has to relate to financial constraints, human resources, purpose of the evaluation and identity of end-user. This chapter elucidates most of the important parameters (objec-

tively verifiable indicators) for economic, social, health, community and environmental impacts.

The sixth chapter focuses on how measurements are taken and what are the best sources of information.

I. IMPACT EVALUATION

A. Historical background

Development of evaluation methodology

Project evaluation, covering efficiency, effectiveness and impact, has developed since the early 1950s. In those days, formal evaluation methodology emerged at both the country level and from within the United Nations system, but the focus was on efficiency and effectiveness rather than impact. It has been only recently that impact evaluation has taken its place as a tool in assessing project worth.

Impact studies in developing countries in the late 1950s started from a narrowly-focused health base then gradually expanded to include broad socio-economic issues by the early 1970s. In the early days, the concern of international development agencies was the impact of their water-supply and sanitation projects on diarrhoeal diseases. Among the first studies, the most notable was a series of empirical cross-sectional studies sponsored by the World Health Organization (WHO) in Bangladesh, Egypt, Islamic Republic of Iran, Mauritania, Sri Lanka, Sudan and Venezuela: these and others are summarized by Saunders and Warford (1976). Relatively few longitudinal studies on the health impacts of water and sanitation projects have been undertaken in developing countries, mainly owing to the difficulties in experimental control (Warner, 1981).

In the mid-1960s, the implementation of rural-development projects in the newly independent countries of Africa and Asia led to an interest in the overall effects of these projects. Studies with broad interdisciplinary foci were undertaken, with a switch from cross-sectional to longitudinal approaches. Some of the earliest field studies of the broad impacts of rural water-supply projects were carried out in East Africa in the 1960s, including comprehensive cross-sectional investigations of domestic water use in Kenya, Uganda and the United Republic of Tanzania (White and others, 1972). By using questionnaires, analysing excreta and urine samples, performing clinical diagnoses and examining existing records, the evaluation team considered the relationships between improved water supply and disease reduction, and the overall costs of the lack of safe water. They suggested a classification system for water-related diseases by the manner in which they are related to and/or transmitted by water: these diseases were divided into four transmission categories - water-borne, water-washed, water-based and water-related-insect-carried.

This classification was refined by Bradley and Feachem in 1977 and a similar conceptual system for diseases related to excreta was developed by Feachem and others in 1978. In East Africa, the

evaluators were able to confirm that water supply alone does not result in substantial benefits. Their approach and methodology greatly influenced subsequent investigators: for example, the disbenefits of inaccessible water which had to be carried over long distances were measured in terms of energy-loss and converted into monetary terms.

Carruthers (1973) was the first person to propose a conceptual model of impact hierarchy, in which improved water supply is considered to bring about "direct effects" (such as increased labour availability) and "second-order benefits" (such as increased crop yields). First-order benefits are still only potential, since they are dependent on certain conditions being met (e.g., user's adoption). In turn, first-order benefits are preconditions for second-order benefits, but the second-order benefits are, in addition, subject to the fulfilment of other conditions as well. Thus, impacts are shown to occur in sequence, in the sense that one level of benefits is dependent on the achievement of a previous level and on the meeting of other conditions. Carruthers' model gave recognition to an integrated approach in impact evaluation and to a holistic view of the project-development cycle, by distinguishing the necessity for complementary inputs. The argument is that water is considered an important but not sufficient condition for development; it requires complementary inputs for success.

In 1975-1976, a broad impact study was carried out by a multidisciplinary team on the rural water-supply programme in Lesotho (Feachem and others, 1978). It consisted of cross-sectional comparisons of water use and detailed investigations of health, community-participation, institutional, political and economic aspects. Unfortunately, the lack of baseline data forced the evaluators to rely on hospital records in the project and control areas. Surprisingly, it was concluded that water supplies, as installed and used in Lesotho, had little impact on health and that diarrhoeas and typhoid were not primarily waterborne. There were no spin-off development activities attributed to the improved water supplies. Feachem's team consolidated Carruthers' argument that there are complex linkages between multiple inputs, complementary preconditions and final impacts, and that water should be considered not as a single input but as an integral component of a development scheme. Their evaluation led to a later comprehensive presentation of evaluation methodology (Cairncross and others, 1980).

Shuval and others (1981) presented a "threshold-saturation theory", linking sanitation, health and socio-economic conditions. The theory states that, for a given socio-economic level, investment results in health improvement but that there is a minimal socio-economic standard below which health benefits are not achieved. Likewise, there is an upper level at which benefits will not increase further. Using adult

literacy data (as a socio-economic indicator) and life expectancy at birth (as a health indicator) from 65 countries, the authors found some tentative empirical support for their theory. Later, results from field studies by Magnani and others (1984) in the Philippines supported this theory.

In the field of health-impact evaluation, Briscoe and others (1985) have proposed the "case-control study" design which may overcome many defects in standard designs. In contrast to other designs, the case-control study (also known as "case history" or "retrospective") proceeds from effect to cause, not from cause to effect. For instance, in a project area having both improved and unimproved water supplies, people reporting to clinics having diarrhoea (the "cases") are compared - with respect to the water sources they have used - with those reporting other infections (the "controls"). Using statistical analysis, the relative risk of diarrhoea among people using unimproved sources in comparison with users of improved sources is estimated. The main advantages of the case-control study over other methods are: (a) the required sample size is smaller; (b) the sensitivity and specificity of the disease measure used are substantially higher; (c) only a single round of data is required; and (d) early results are available. Although still having some methodological problems, the case-control study design holds promising potential that warrants development of detailed procedures and field-testing.

Donor agencies have only recently systematically formulated project-evaluation methodologies. For example, the Canadian International Development Agency (CIDA) adopted a Logical Framework Analysis approach in 1980, focusing on three levels of evaluation, project efficiency, effectiveness, and impact. A similar project evaluation model, focusing on system operation, performance and impact, was suggested by the United States Agency for International Development (USAID) (Warner, 1981). These two project-assessment models coincided with a third defined by WHO (1983), in which identical levels of evaluation were defined as system functioning, utilization and impact. The convergence of methodology is illustrated below:

CIDA	USAID	WHO
Evaluation foci	Evaluation levels	Evaluation types
Efficiency	Operation	Functioning
Effectiveness	Performance	Utilization
Impact	Impact	Impact

In summary, impact evaluations of water-supply, sanitation and solid-waste-disposal projects first focused on disease. Gradually, studies of economic values of health improvements, in terms of reduced medical-care costs and increased labour productivity, emerged. Recently, impact-evaluation studies have expanded their coverage to social, economic and institutional aspects within a systematic Logical Framework Analysis.

From the donor's viewpoint, the current situation is best described by CIDA (1977):

"For a long time, it was thought that evaluation was not really necessary as long as the parties involved were reasonably satisfied with what had been achieved.

"Over the years a more critical attitude has emerged. In spite of the growing resources allocated to foreign aid, the gap between the rich and the poor has been widening steadily. Politicians, journalists and the general public want to be better informed about the effectiveness of the aid which is paid out of their tax dollars. Accordingly, the agencies which plan and manage development projects must take a hard look at their operations".

Some examples of impact evaluation

Selected examples of impact evaluations from a variety of developing countries are summarized in this section. Although the review is neither comprehensive nor complete, it does give an overview of how project evaluation has evolved. 1/

Kenya. Carruthers (1973) reviewed the impact and economics of water-supply projects in Kenya. One of the early studies was undertaken around 1965 and applied both longitudinal (before and after) and cross-sectional (with and without interventions) approaches. It indicated that piped water did not bring about significant gains in labour productivity from health improvements, although, besides striking health improvements in children, there were improvements in housing conditions and vector control. However, this 1965 evaluation is beset with technical and sampling problems that make the extensive data difficult to interpret (White and 8 others, 1967).

The Philippines. A six-year evaluation of the Provincial Water Project was carried out for USAID through three rounds of household surveys, to measure impact indicators and explanatory variables. The first survey

1/ For comprehensive reviews, see Esrey and others (1985), Feachem (1984), Hughes (1981), McJunkin (1982), Saunders and Warford (1976) and UNICEF (1983).

was conducted prior to project implementation, the second one to two years after the completion of the project water systems, and the third about five years after completion. The evaluation was quite elaborate, and statistical analyses were extensively applied in data processing and presentation, using sophisticated computer programmes. Given these factors, the results may be considered disappointing, but the lessons gained were valuable:

- The magnitude of economic gains from increased household businesses could not be quantified with the data available.

- There was no conclusive evidence that the project had a substantial health impact.

- The five years allowed for health impacts to appear may not have been sufficient for those impacts to mature.

- Considering the rapid deceleration of economic growth in the country during the evaluation period, it was possible that benefits of the project (e.g., on nutritional status) were offset by deteriorating economic conditions in the project area.

- Some potentially useful morbidity data were lost, owing to poor quality control in data collection and processing during the baseline survey.

When this study was designed (1974-1975), there were no existing USAID guidelines or precedents for water-supply project impact evaluation, and one of the objectives of the evaluation was to establish evaluation methodology for the agency. It was concluded that the evaluation design had methodological problems and should not be replicated in the future. Instead, "smaller-scale, cheaper and more efficient methods" which "favor the measurement of short-term project effects instead of long-term health impacts" were suggested (Magnani and others, 1983).

Thailand. An ambitious Potable Water Project in rural Thailand was implemented during 1966-1972,

United Republic of Tanzania. Impact evaluations of water-supply projects in the United Republic of Tanzania revealed some unexpected results and problems. Some interesting findings (Heijnen and Conyers, 1971; Westman and Hedkvist, 1972) are:

- Confounding variables were numerous; for example, many schemes were implemented in settlements where people had already been better off than others in the same area who were not served at all by the project.

- The distance travelled to obtain water was not always reduced with improved water supply; in some cases, it increased during the wet season, because of the switch from traditional sources to improved sources or because more trips were made than before.

- People living less than five minutes' walk from a water tap spent more time collecting water than they did before project completion, owing to increased water consumption.

- In one area, the cattle population showed a rapid increase following the completion of a reservoir, causing overgrazing and soil erosion.

- As the project area had already experienced rapid economic growth, it was impossible to say how much spin-off development was attributable to the project.

- Expected spin-off economic development activities (such as irrigation and fish culture using water from new supplies) did not materialize, owing to lack of technical support for these activities.

The message from these evaluations is clear and sounds a warning to countries implementing their water programmes with unrealistic targets and exaggerated benefit predictions. Warner (1973) later conducted impact studies of water-supply projects implemented in the United Republic of Tanzania during 1968-1970. Longitudinal studies, using household questionnaires, field-testing, observations and records, were carried out on project and control areas.

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