THE ITRC RAPID APPRAISAL PROCESS (RAP) FOR IRRIGATION DISTRICTS

Stuart Styles[1]
Charles Burt[2]

ABSTRACT

The ITRC Rapid Appraisal Process (RAP) for irrigation projects was created in 1989 as a tool to quickly provide valuable insight into many aspects of irrigation performance including project design, engineering, operations and management. The RAP is a 2-week process of collection and analysis of data both in the office and in the field. The process examines external inputs such as water supplies, and outputs such as water destinations, and provides a systematic examination of the hardware and processes used to convey and distribute water internally to all levels within the project (from the source to the fields). The organization and content of the RAP provides a systematic project review that enables an evaluator to provide pragmatic recommendations related to hardware and management for the improvement of water delivery service.

INTRODUCTION

The Irrigation Training and Research Center (ITRC), California Polytechnic State University, San Luis Obispo, is actively involved with finding solutions to improve irrigation performance. ITRC has a history of over 20 years of working with irrigation districts and agricultural water users to develop, implement and monitor strategies for improving irrigation performance.

Since 1989, ITRC has pioneered work on the Rapid Appraisal Process (RAP) for distribution systems for irrigation projects. In general, the RAP is a quick and focused examination of irrigation systems and projects that can give a reasonably accurate and pragmatic description of the status of irrigation performance, and provide a basis for making specific recommendations related to hardware and management practices.

An RAP is designed to:

- Identify specific and immediate actions that could be easily taken, with a minimum of investment, to improve operation and water management

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[1] Director, Irrigation Training and Research Center (ITRC), BioResource and Agricultural Engineering Department, California Polytechnic State University (Cal Poly), San Luis Obispo, CA 93407
[2] Chairman, ITRC

- Quickly critique options that have been proposed for major future investment
- Provide a fresh look at the whole system, with the goal of being able to provide suggestions for new ways to improve the overall irrigation distribution system

This paper will focus on the RAP approach applied to irrigation districts, and will discuss how and why the RAP was created, what the necessary components are for a successful appraisal, and why the ITRC RAP is unique in its thoroughness and effectiveness.

HISTORY OF THE RAP

The RAP was initially developed as a set of recommendation-orientated irrigation system evaluation procedures for different on-farm irrigation methods. In 1983, ITRC began to develop standardized procedures for evaluating on-farm irrigation systems with support from the Water Conservation Office, California Department of Water Resources (WCO/DWR). The result was the Cal Poly ITRC on-farm irrigation system manual and software package that has become the standard for field evaluations in the Western U.S. (Burt et al. 1995).

The Rapid Appraisal Process was designed in 1989 out of the techniques used for the irrigation evaluations. ITRC has successfully used variations of the RAP approach as a diagnostic and research tool in a wide variety of situations both in the U.S. and internationally (Burt et al. 1996, Burt and Styles 1999, Burt and Styles 2000).

The use of a systematic RAP for irrigation projects was introduced in a joint FAO/IPTRID/World Bank publication entitled *Water Reports 19 (FAO) – Modern Water Control and Management Practices in Irrigation – Impact on Performance* (Burt and Styles 1999). That publication provides an explanation of the RAP approach and gives the results from RAPs the authors conducted at 16 international irrigation projects. Refer to Water Reports 19 for further background to the RAP approach, available directly from FAO (http://www.fao.org/icatalog/inter-e.htm).

OBJECTIVES

The first step in evaluating irrigation performance, whether at the farm level or an entire irrigation district, is to perform a rapid appraisal of the system as it is being operated. In typical project evaluations, a common error is that there is no daily operational strategy for moving water around in the system that relates to the detailed engineering recommendations.

It is essential that hardware or automation recommendations be linked to such an operation plan and strategy if the investment is to provide maximum benefits. When this is not done properly (as in many cases), it is almost inevitable that the wrong types and sizes of structures are installed, and key regulation and operation structures are overlooked. Further, it is critical that recommendations to irrigation districts keep in mind the economic reality of irrigated crop production. Expensive structures and computerized automation systems may look nice but may have little or no impact on the level of water delivery service provided to farmers.

The RAP approach allows ITRC to assist irrigation districts and agricultural water users in quickly identifying and prioritizing the specific changes in their water management practices that will provide cost-effective improvements in the performance of their distribution systems. Many times irrigation districts are aware of the potential to improve their operations, but they lack the knowledge or experience with current water control and measurement technologies. An irrigation district will have distinct hydrologic, engineering, operational and agronomic conditions, in addition to a history based on local agricultural practices, which will affect its ability to meet specific performance objectives. Moreover, some districts may not even be aware of the appropriate ways of thinking about performance in terms of service to farmers and water conservation.

A key component of the successful application of the RAP approach is the knowledge and experience of qualified technical experts that can make proper design and modernization decisions. It is critical that RAPs be conducted by irrigation professionals with an extensive understanding of the issues related to irrigation water control. In addition to making proper recommendations for modernization, evaluators using the RAP approach must have the ability to synthesize the technical details of a project with the concepts of water delivery service into a functional design that is easy to use and efficient.

PROCEDURE

As a center of irrigation excellence with state-of-the-art facilities, ITRC is able to work with irrigation districts in assessing the potential for improvement in their operations and then provide support and training for personnel through technical assistance programs. The RAP is the first step in accomplishing these goals.

The RAP can generally be completed with two weeks or less of field and office work. The process involves a pre-site visit survey sent to the district, followed by 1-2 days of field time by key ITRC personnel to visit the irrigation district to meet with district personnel, collect available data, and visit major structures in the system. Additional time, usually 2-3 days, is required to develop specific engineering recommendations for items such as Supervisory Control and Data Acquisition Systems (SCADA), flow measurement or canal gate automation techniques, design of water control structures, etc.

Survey Questions

A key to evaluating the distribution system for an irrigation district is to target the key factors that influence the performance of the structures and operational procedures used to convey and distribute irrigation water. One begins the RAP with a prior request for information from the irrigation district. Information such as crop types, irrigated acreages, flow rates into the system, weather data, budgets, staffing levels, existing water conservation programs, and pumping records can be assembled beforehand and then reviewed by the evaluator and project managers during a site visit to the project.

ITRC has been involved with water conservation projects and modernization programs at dozens of irrigation districts in the Western U.S. A library of information about each district is maintained and updated to reflect ongoing technical assistance programs.

The following is a general outline of the issues that need to be addressed before a set of recommendations can be made:

General Irrigation District Characteristics

- General Project Conditions
- Reservoirs
- Drainage
- Groundwater
- Crops
- Water Supply
- Water Use

Irrigation District Operations

- Water Delivery System Characteristics (Main and Lateral Canals)
- Flexibility- Frequency
- Flexibility- Flow Rate
- Flexibility- Duration
- Flexibility from Water Suppliers
- Flow Measurement at Farm Turnouts
- Facilities and Upgrades

Irrigation District and Farm Economics

- District-Level Economics
- Water Billing
- Farm Economics

Status and Needs of Modernization Programs

- Water Delivery Service

- On-Farm Improvements
- Canal Improvements
- Water Conservation Programs
- SCADA
- Training and Education

Site Visit

Upon arriving at the project, the data gathered through the survey is organized and project managers are interviewed regarding missing information and their stated perceptions of how the project functions. The evaluator then travels down and through the canal network, talking to operators and farmers, and observing and recording the actual methods of operation and hardware that are used for water control. Through this systematic diagnosis of the project, many aspects of engineering and operation become very apparent.

Interpretation of RAP Results

The RAP, by itself, is only a diagnostic tool. It allows a qualified evaluator to systematically examine the irrigation project. Through FAO and World Bank funding, the authors have developed a set of EXCEL spreadsheets with two characteristics:

1. Several hundred questions are provided that evaluators must answer in a standardized format. Questions cover topics such as water supply, personnel management, canal structures, level of water delivery service throughout the project, and numerous related topics.

2. The values of a large set of external and internal indicators are automatically computed. The automatic computations provide rapid results and also eliminate computation errors.

> External indicators are expressions of various forms of efficiency, whether the efficiency is related to budgets, water, or crops yields. They only require knowledge of inputs and outputs to the project – but by themselves they do not provide any insight into what must be done to improve performance. Traditional irrigation project investment decisions are based on these indicators. Internal indicators examine the hardware and processes that are used to actually move, sell, and schedule water throughout the project on an hourly, daily, and seasonal basis. (Burt and Styles 2003)

The interpretation of the results requires one or more irrigation specialists who clearly understand the options for modernization. Without a thorough knowledge of these options, the recommendations can be ineffective or damaging.

For example, a very common mistake in modernization plans is the elimination of first-time losses with the belief that this will improve project irrigation efficiencies—even though those first time losses may already be recirculated within the project. If this is the case, there may not be any true water conservation.

In general, the process of interpretation involves the examination and review of the following six components:

1. Field irrigation efficiencies

2. Project irrigation efficiencies

3. Conveyance efficiencies (compared against field irrigation efficiencies)

4. The attributes of water delivery service

5. The appropriateness of hardware and operator instruction

6. The existence of recirculation systems

The process of implementation is as follows:

1. A first step is to eliminate any discrepancy between "actual" and "stated" service. Some project managers do not fully understand that there even is a discrepancy.

2. Frequently, the instructions that are given to operators need modification. Sometimes, these modifications are simple and result in significantly improved operations.

3. The next steps, more or less in order of sequence, are to improve the following areas:

    a. Understanding of what actually happens in the system. An expert can quickly evaluate a project and because of his or her background, almost immediately understand cause/effect relationships and the probable level of service.

    b. Communications at all levels. This starts with human-human communications – often with radios or cell phones.

    c. Mobility of staff. In general, a small yet mobile staff is much more efficient than a large, immobile staff.

d. Flow rate control and measurement at key bifurcation (canal split) points. Note that “measurement” and “control” are not the same. Both are needed.

e. Construction of recirculation points or buffer reservoirs in the main canal system.

f. Improved water level control throughout the project. The flow rate control and measurement (item “d”) only pertain to the heads of canals, laterals, and pipelines. Downstream of the heads, it is important to easily maintain fairly constant water levels so that turnout flow rates do not change with time, and so that the canal banks are not damaged. With the proper types of structures, this is easy to do without much human effort.

g. Re-organization of procedures for ordering and dispersing water. In most modern projects, one group is responsible for operating the main canal; another is responsible for the second level, and so on. The complete procedure for receiving real-time information from the field and responding quickly to requests must typically be revamped for most projects.

h. Remote monitoring of strategic locations. Such locations are typically buffer reservoirs, drains, and tail ends of canals.

i. Remote manual control of flow rates at strategic locations. These are the heads of the main canal, and heads of major off takes (turnouts) from the main canal.

j. Provision for spill, and the recapture of that spill, from the ends of all small canals.

What may seem surprising to some is the complete lack of discussion of canal lining and maintenance equipment. There is no doubt that maintenance equipment must be adequate. Canal lining can reduce maintenance and seepage. But these topics have been discussed for many decades, and the billions of dollars that have been spent on canal lining have generally not brought about modernization. Concrete canal replacement has also been proven not to be a viable solution for most projects. This is because modernization is not just a single action. The items "a-j" above represent a departure from traditional thinking of “concrete civil engineers” and focus on operations.

ITRC also does not employ GIS imaging in its results because GIS maps and charts, although visually appealing, generally reveal only superficial issues. At best, these graphics display where symptoms of problems exist without dealing with their more subtle, underlying causes. Mapping and surface studies alone do not take into account management issues, communications, procedural analysis, remote control and automation failures, or overall structural or organizational problems. The ITRC approach focuses on the interpretation and evaluation of findings, not the findings themselves.

SUMMARY

The ITRC RAP deals with a broad spectrum of analyses on several different levels. When properly executed by trained evaluators, the RAP approach can quickly provide valuable insight into many aspects of irrigation performance including project design, engineering, operations and management. Furthermore, the organization and content of the RAP provides a systematic project review that enables an evaluator to provide pragmatic recommendations related to hardware and management for the improvement of water delivery service. The ITRC approach has been refined by over two decades of experience and application, and has stood the test of time as a proven, internationally recognized method of irrigation system evaluation.

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