MONITORING AND EVALUATION (M&E) OF CAPACITY DEVELOPMENT FOR IRRIGATION MODERNIZATION

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ABSTRACT

Effective capacity development monitoring and evaluation (M&E) depends first upon targeted capacity development programs, with well-defined and attainable objectives that can be evaluated after completion of the program. This paper focuses on capacity development related to technical issues of irrigation modernization.

ITRC performs diagnostic research on irrigation projects and field irrigation systems in advance of developing targeted capacity development programs. If the capacity development is appropriate, and if it is targeted in both content and to specific audiences, one can expect an eventual improvement in post-capacity-building performance. ITRC has found that the improvements are incremental, and often require substantial changes in internal indicators (such as reliability, improvement of structures, etc.) before external indicators such as irrigation project efficiency can be noticed. Therefore, evaluation (before and after) requires acknowledgement of process indicators as well as external indicators.

INTRODUCTION

"Capacity building" for irrigation modernization has become a popular phrase. Effective capacity building programs intended to develop/strengthen technical skills require several magnitudes of effort and resources (attention, financial resources, time) beyond what are currently being allocated to most projects. It is unrealistic to expect a technical capacity building program to be based on one or two, two-week short courses. Capacity building for irrigation system modernization is a complex, long-term effort that must be carefully targeted, requires highly qualified instructors, needs continual feedback, and must involve field implementation and evaluation to be effective.

The author has been involved in over a dozen short-term capacity building efforts in international projects. They have all been helpful as starters, but in general they been insufficient for sustained improvement. This paper will focus on the successful strategy that the author and others at ITRC have implemented to support successful modernization efforts in well over a hundred irrigation projects in the western USA.

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THE EFFECTIVENESS OF CAPACITY BUILDING PROGRAMS

Before the idea of a capacity building program can be approached, the question always arises as to whether or not such programs are effective. The answer to this is simple: Sometimes. Historically, a project's effectiveness has depended upon the specific effort that was made, and how it was done.

The difficulty in declaring a project a success lies in the amount of time it takes for results to manifest themselves. This can take from years to decades, depending upon the program's starting point. The author frequently begins discussions of modernization and capacity building efforts in western USA irrigation projects 5-10 years before the first modernization steps begin. Once things begin to happen, success generally requires a slow, methodical approach in which ideas are tested and proven, and acceptance is gained for new ideas. Therefore, significant proof of success may not occur until 10-15 years after initial efforts are made. Other cases, of course, are more rapid. But a minimum of several years is generally required to even begin to see results.

When considering Monitoring and Evaluation (M&E) of capacity building, it is logical to ask what eventual results should be expected. However, there can be significant benefits by examining the program itself, rather than waiting for results. Therefore, the M&E should address process-oriented questions such as:

- What quantifiable objectives (QO) were defined before the start of the capacity building exercise? Two criteria go along with this question:
  - The objectives must be realistic; they must be attainable.
  - The capacity building program must be carefully targeted to address the specific objectives. Otherwise, it is unfair to evaluate the program based on objectives that were not stated or which did not exist.
- What time scale was assigned to achieve these QO's?
- Exactly how were these QO's to be evaluated? Or more specifically, was it even known what the original condition was?
- Do the QO's involve process, internal indicators, or external indicators for the project itself? For example,
  - Process may include the mechanism of computing irrigation routing, and communications.
  - Internal indicators may include a measure of the reliability and flexibility of water delivery to fields – which should be a result of improved irrigation routing and improved communications.
  - External indicators may include improved payment of water fees, higher yields and increased cropping intensity, or reduced diversions.

In addition, there are other points that can indicate whether a capacity building has or will be successful. An M&E program can benefit by examining whether the following have occurred:

- Something has actually changed in the project, and that action persists over time. That is, the project authorities, farmers, or other interested parties accept the action as beneficial and work towards maintaining and expanding it.
- Conversations among irrigation professionals begin to include correct new concepts of efficiency, water conservation, the service mentality, etc.
- Grant and loan programs, and approval of new projects, include requirements related to proven water or energy conservation, water quality improvements, provision of better service to farmers, or other specific targets.
- Politicians and funding agencies at least pay lip service to effective modernization concepts, and allow appropriate projects to be funded.
- Papers are published and presented in local technical journals that are based on successful, sustained implementation of modernization principles – as opposed to descriptions of policy, plans for a project, theoretical models, and other paper ideas.

Are the Capacity Building and M&E Programs Realistic?

The M&E program should include an initial analysis of what capacity building needs exist, and if there is sufficient funding and support to implement the knowledge gained through capacity building. Perhaps one of the first steps in any M&E program is to define whether the capacity building program is properly targeted, and whether it will succeed. If the answers are "no", the capacity building program should be re-defined or delayed.

There appear to be certain external circumstances essential for success, all of which must be met prior to beginning a capacity building program. Identifying these should be part of the M&E program. They include:

- A true need for irrigation performance improvement must exist – whether it be related to the environment, crop yields, or energy consumption.
- Both trainees and their bosses must perceive that there is a need for improvement.
- Adequate funding must be available to implement modernization programs. Without successful field applications, the capacity building will remain a theoretical exercise.
- There must be adequate funding for long-term (approx. 10 years) capacity building.
- If an M&E program is planned, there must be a well-defined program, with well-defined objectives, and sufficient funding that extends past the capacity building period.
- Adequate funding, time, and resources must be allocated to work through the inevitable problems that occur with any modernization program – regardless of how simple. "The devil is in the details", and if all of the details are not taken care of, the implementation of a modernization effort will fail. With failure of field implementation, the capacity building effort will fail because there is nothing to show for it and people will be demoralized.

The success of a capacity building program is dependent upon the successful implementation of the knowledge gained.

An ideal M&E program, even if modest in nature, should be incorporated into the capacity development effort in the very early stages of the thought process. This stems from the fact that

the success of a capacity building program is highly dependent upon the organization and skills of the instructors and how the material is presented in the earliest stages of a capacity building program.

The reality is that there is often a very limited choice in instructors. However, a pragmatic M&E program does need some way to gauge the capacity development training process itself in addition to the irrigation project's circumstances and results. In reality, there exist certain "process indicators" in the capacity development program itself:

- The instructors must have practical field experience – not only in design, but also in field construction, and in living with their designs and in receiving criticism for problems. The instructors must be "real world" people who can distinguish between simply theoretical, interesting topics, versus those that are actually important.
- Some topics are strictly technical in nature – such as how to design a broad crested weir. But knowing the hydraulics is simply insufficient to be a qualified instructor. The person who teaches about the weir design must also be very familiar with why so many field installations of broad crested weirs have failed….and how to avoid those failures in the future.
- Beyond the strict number-crunching issues, there is a whole different level of expertise that must permeate a successful capacity building program. At least some of the instructors must also understand strategies of project modernization, and how to select various strategies under various conditions. These are the people who would know why a weir is even needed in a particular application, how it would be used, how it ties into the overall operation….and why that particular device was selected rather than another.
- The training topics must be targeted to the specific audience. If they are not, they will be interesting at best. At worst, the audience will become indignant (unless, of course, the capacity building is held at a nice resort and only requires a few hours per day).
- The training topics must be targeted to problems that can realistically be solved by the specific audience.
- In all but the most extreme and narrow cases, it is completely inappropriate to use calculus, differential equations, complex simulation computer models, etc. for capacity building that trains people who will be involved in actual planning, design, and implementation of irrigation modernization.

For some people involved in irrigation projects, a few capacity building sessions are adequate to raise awareness and to provide a few tools. But other individuals must deal with more complicated problems that require considerably deeper training and repeated refresher sessions and backup.

The programs must absolutely do more than have classroom and laboratory sessions prior to irrigation modernization efforts. Capacity building programs must include support for people who are actively implementing modernization. These people will need backup at a variety of stages in their attempts in order for them to be successful and to gain confidence.

Capacity building includes support before, during, and after implementation of new concepts, software, and hardware in the project.

Benchmarking – A Buzzword for the M&E Process

Success requires meaningful improvement over previous conditions. For irrigation projects, this entails the improvement of performance indicators. In the western U.S., ITRC uses a shortened version of the ITRC Rapid Appraisal Process (RAP), developed for FAO and The World Bank, to diagnose internal project operations. Many of the performance indicators and benchmarks that are included in the ITRC RAP are now common knowledge by irrigation districts. However, a diagnosis of system operation and internal solutions is still needed.

Table 1. Example irrigation projects that have received an ITRC RAP in the western USA

	Irrigation District				
	Imperial	Turlock	East Columbia Basin	Panoche WD	Chowchilla WD
Location	Southern California	Central California	Eastern Washington	Central California	Central California
Irrigated Ha.	189,000	60,000	61,000	15,000	38,000
Age (yrs)	110	140	60	70	110
Administration	Public; each voter has one vote	Public; one vote per registered voter	Public; 1 vote/farmer	Public; one vote per acre	Public; one vote/acre
# of turnouts operated by district personnel	5600	1700	2500	142	850
% of canal structures automated	5	10	3	5	40
Approx. % of laterals piped	1	90 (monolithic large dia concrete)	5	0	10 (monolithic large diameter concrete)
Approx. % of canals lined	90	90	5	90	10
Density of turnouts (offtakes)	One/field	Delivers to private laterals serving 2-50 fields.	One/field	One/field	One/field
# of Irrigation Districts	1	1	3	1	1
State/federal assistance (0=none; 10=major)	2	1	8	5	1

Therefore, a basic concept of evaluation of the success of a capacity building program is that the pre-project condition must be benchmarked properly. The definition of "sufficient" benchmarking will vary depending upon the irrigation project. U.S. modernization projects are generally categorized by either of the following motives:

Internal Initiative and Funds
Districts that completely self-fund their modernization efforts typically have these essential characteristics:

1. The manager, engineers, and operators are generally empowered to be innovative.
2. The irrigation districts are governed by a board of directors who are completely responsible for setting the budget and fees. The board will not spend money unless the members sense that there is a true need – because that money must be collected from them in the form of higher water fees.
3. The irrigation districts place little importance on fancy reports. They want to deliver water with good service at a low price. Therefore, they are very pragmatic and understand their budgets.

Because of these characteristics, the benchmarking that is done is often very simple and does not involve developing many classical "performance indicators". The management knows what types of problems exist, but generally does not know the causes/effects or how to solve them. If the modernization effort eliminates their problems, they consider it a success.

In the U.S., the primary **internal** indicators that have been used are related to flexibility of water delivery and various budgetary items. The flexibility is understood by the farmers, and also by the operators. For the operators, flexibility is generally associated with hardware modifications that enable them to manipulate unsteady flow rates with ease – and the operators quickly respond positively to those improvements.

External Forces

In other circumstances, external forces (environment, power costs, etc.) drive the desire to modernize an irrigation district. Funding is typically a combination of irrigation district sources and outside grants (federal or state government). In these cases, the initial emphasis is typically on solving the external requests. That often requires benchmarking of **external** indicators in the form of a water balance – or at least determining a few key indicators such as the volume of spill. But it also requires an excellent understanding of the internal processes involved in moving water around within the project. In general, U.S. irrigation districts already have excellent records of the volumes of water that are brought into the district.

ITRC develops modernization efforts to simultaneously solve both internal and external problems – even though the external problems are the driving force for action. Quite often, improvement of internal indicators (such as improved flexibility of delivery, better water level control, improved communication, etc.) is necessary to achieve the external goals (such as reduced spill, fewer diversions from an impacted river, etc.).

CAPACITY BUILDING FOR IRRIGATION MODERNIZATION TECHNICAL ISSUES – WESTERN USA -

In the western U.S., irrigation districts were often constructed with the help of U.S. Bureau of Reclamation (USBR) design guidance. Most irrigation projects were put in place several decades ago, and gradually the availability of pragmatic technical assistance from U.S. federal and state agencies has declined. Government agencies began to focus more on environmental monitoring and similar programs rather than the bolts and nuts of making things work in irrigation projects.

However, the federal government agencies had historically developed a wealth of technical literature and research that was used in various publications and universities. Most hydraulic texts in university civil engineering programs used parts of that information. However, in the past 20 years irrigation engineering has largely disappeared from U.S. university curriculums (the BioResource and Agricultural Engineering Department at Cal Poly State University, San Luis Obispo is a rare exception) and it would be extremely unusual for a civil engineering student to have had even one irrigation class. Instead, a typical civil engineer may have a couple of fluid mechanics classes.

As of the late 1990's, most of the universities that had large irrigation programs focused on international work instead of focusing on modernization in the U.S. Also, although the USBR continued (and still continues) to have an excellent research center and does have an annual short course on canal operation, the direct technical assistance from the USBR for irrigation district modernization became minimal. The net result is that new U.S. engineers typically have little or no background in the special aspects of irrigation project hydraulics and operation – and they are indeed special. In short, U.S. irrigation districts were entering a critical time of environmental and power problems with little technical support.

Starting in the middle 1990's, the Irrigation Training and Research Center (ITRC) began to offer limited technical assistance to irrigation districts – generally via various U.S. or state grants for capacity building. Gradually, ITRC received contracts from various USBR area offices to provide technical assistance for modernization in those areas. Now, ITRC provides technical assistance for modernization on behalf of the USBR in much of the western U.S., is directly hired by numerous irrigation districts, and manages programs for the California Energy Commission, the EPA, and others for irrigation districts.

The capacity building by ITRC in the western U.S. is very deliberate. It has involved the following aspects:

1. Diagnostic research on approximately 150 districts to benchmark key indicators related to water charges, structures, flexibility (detailed components of frequency, rate, and duration), attitudes, etc. This initial benchmarking of districts in general helped to shape various training programs, research priorities, and technical assistance programs.

2. Construction of a large outdoor training facility at ITRC to assist in teaching concepts of flow measurement and control, water level control, pumping, sensors, SCADA, etc.

3. A wide array of short training courses has been developed, along with customized training materials. Subject matters include:
    a. Flow measurement in open channels
    b. Flow measurement in pipelines
    c. Pumps – introduction and advanced
    d. Variable frequency drive controllers
    e. Canal control concepts
    f. Specific canal control design subjects
    g. Supervisory control and data acquisition (SCADA) systems

h. Hand held data recorders
i. Basic hydraulics
j. A whole host of related farm irrigation classes including drip/micro irrigation, chemigation, sprinkler design, irrigation scheduling, drainage, soil-plant-water principles, irrigation evaluation, and pumps.

4. These classes are tailored to fit the audience and location. Examples include:
   a. At the ITRC, several two-week series of classes are scheduled annually. Irrigation district and engineering firms send employees to these every year.
   b. Customized classes, usually 1-2 days in length, are often developed for operators at specific irrigation districts. Those are customized for the hardware and management that exist in those districts.
   c. Prior to modernization efforts in irrigation districts, ITRC attempts to bring the complete Board of Directors, along with staff, to ITRC for a short course on basic principles of modernization as they apply to that district. This gives everyone a common vocabulary and a common understanding of basic ideas. This has been very successful.
   d. Some irrigation districts send groups of operators to ITRC for special short courses designed just for the operators of their specific district.
   e. Some series of courses are designed for engineers (private and district) and managers; others are designed for operators.
   f. As new topics arise, such as new commercial software for irrigation ordering, hand held data recorders, some particular new technology related to SCADA, or new techniques for canal membrane lining, ITRC works with groups of manufacturers to provide a single one-day session for irrigation districts.

5. A key aspect of the training is that the materials and subjects are constantly upgraded based on field experiences of the training staff. The same persons that do the training are constantly involved in modernization projects with irrigation districts, as well as having academic degrees in irrigation engineering.

6. ITRC has an active web site that provides technical information to irrigation districts (www.itrc.org).

7. For anything related to sensors, electronic automation, PLCs, SCADA, etc. the cardinal rule in capacity development is to teach people how to use commercial equipment effectively, rather than attempting to develop low-end products locally. Developing local low-end electronic products and software is an almost certain guarantee for failure and a waste of capacity development efforts.

8. For effective modernization, all levels of personnel are involved in capacity development – including managers, engineers, maintenance staff, and operators. Farmers also receive information about what the modernization will and will not do.

9. Capacity development requires continual re-affirmation of basic principles, which take a single session to teach, but recurrent repetition to learn. The re-affirmation does not need to come in the form of a regular class, but repeated visits by qualified technical experts are required after training during planning for and execution of modernization plans. It is during those visits that questions are asked and answered, points clarified, ideas expanded upon, and progress reviewed. Even after new structures are installed, it may take 1-2 years before everyone understands how to use them.

M&E FOR CAPACITY BUILDING – ITRC APPROACH

Although the author has defined the capacity building effort that ITRC directs for the western USA, the M&E approach for ITRC projects is somewhat non-traditional.

In the western U.S. the M&E programs have traditionally been implicit rather than explicit. Much of this is due to the way ITRC has developed and carried out its capacity building programs. ITRC has the following characteristics:

- An excellent staff of motivated people, who have designed and defined topics and techniques for the capacity building programs under individual impetus rather than government mandate.

- Agencies generally fund specific short courses through ITRC, and participants must almost always pay to attend. In addition, agency funding is required for short course development and upgrading, and construction of training facilities.

- No permanent funding. This is a key aspect of ITRC's efforts. ITRC is not a government-established program; it is not supported by the University, but instead supports the University irrigation teaching programs. Because of this, ITRC operates through the law of supply and demand, more like a business than a government organization. ITRC must be extremely responsive to true Capacity Development needs of their customers. If the customers are not provided with information and assistance that they find valuable and responsive, they will simply stop attending the ITRC short courses. In the western USA irrigation world, news about successes and failure and poor information travels very fast. ITRC must continually listen to districts, come up with new ideas, and respond well.

The lack of centralized funding for capacity development, and the self-motivated aspect of ITRC, are probably key reasons that a formal M&E program does not exist. The process is simple. If people stop coming (and stop paying to come) and the feedback from the field is that the ideas are not being implemented, then it is obvious that the capacity building is not effective. In turn, if the irrigation districts tell the funding agencies that the ITRC programs are ineffective, the funding agencies will stop funding program development.

CONCLUSION

In the western U.S., there is no M&E program of capacity development by any central agency. Capacity development for technical expertise in irrigation modernization has evolved. In addition, most international programs still lack formalized M&E programs.

The usefulness of an M&E Program lies primarily in its application during the formative stages of Capacity Development. Success depends on proper funding and proper design of pragmatic programs to solve real-world problems. Locating qualified trainers is perhaps the weakest link in the process.

An M&E program must determine:

1. If the objectives (process, internal, and external) of the Capacity Building Program have been clearly established.
2. If the objectives have been properly established through previous benchmarking efforts, a clear understanding of the present situation of irrigation projects, and perceived needs and available funding.
3. If the capacity building program has been specifically designed to address the defined needs and objectives.
4. If the proper audiences have been identified.
5. The status of the internal functioning of the capacity building program. That is, are the people qualified and motivated, is the program properly financed, and is the capacity building being done in a pragmatic fashion?
6. How does the capacity building program define success? Are there quantifiable objectives? How are they measured?

Only item #6 above relates to evaluation of results. Items 1 through 5 – used to develop the program – help ensure the success of the program.