



## **The Management Improvement Program (MIP) \***

*A process for improving the performance of irrigated agriculture*

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**Abstract.** Enhanced long-term management of natural resources, farmer profitability, and overall social well-being are essential to sustainable irrigated agriculture. Because these objectives often seem to conflict, all agricultural stakeholders – farmers, irrigation districts, support and regulatory government agencies, and other interested parties – need to interact proactively to identify and address common needs. To this end, the Management Improvement Program (MIP) was tested in the Maricopa-Stanfield Irrigation and Drainage District (MSIDD) area in central Arizona, USA, as a managed change process to improve the performance of an irrigated agricultural system. The three-phased MIP process consists of (1) analysis of the current performance of the agricultural system, on- and off-farm, to gain a common, shared understanding; (2) development by the stakeholders of plans for alternatives to address identified opportunities for improvement; and (3) collaborative implementation of the plans. This paper describes the MIP process and its methodological origins, provides an account of the initial application of the MIP process to an irrigated agricultural system in the United States, and highlights some important outcomes of the MIP application.

**Key words:** collaborative approach, interdisciplinary, integrated resource management, irrigation management, irrigation performance, managed change, strategic change, strategic management, sustainable agriculture, systems change, water conservation

### **Introduction**

Throughout the past two decades, the need for change in irrigated agricultural practices and institutions has been a major concern of national governments and international finance organizations involved in irrigation development. The large body of literature that has been produced on this subject in those

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years attests to those concerns. Key problems confronted by irrigated agriculture include competition for water by alternative users, degradation of the soil and water resource due to water delivery system and on-farm water mismanagement, inadequate return on investment to local and national governments or to international lending institutions financing irrigation projects, and social inequities generated by the unequal access to the water resource. The question, therefore, is not whether irrigated agriculture has to change but, rather, what short- and long-term changes will make these systems environmentally and financially viable and how to make such change efforts self-sustaining.

The complexity of the agricultural activity and the diversity of interests affected by water management decisions make the development of strategies to accomplish these goals a difficult task. In addition to producers, government support and regulatory agencies, services providers, food and fiber processing industries, financial institutions, urban communities, environmental interests, and others have a stake in the well-being of the agricultural system. These entities often pursue conflicting objectives and generally do not coordinate their actions on issues of common concern. Therefore, there is a need for a holistic process to guide change in irrigated agriculture that takes into account multiple stakeholder goals and priorities. A report by the National Research Council (NRC 1996) emphasizes the need for such processes, stating that the future of irrigated agriculture “will depend on the ability of agriculture, urban water users, and environmental interests to commit to a collaborative process of achieving mutually acceptable solutions to...water resource challenges.” The report further observes, “experience indicates that when problems are addressed at the local level, with all stakeholders participating, lasting solutions are possible.”

In an effort to bring about such changes, the U.S. Water Conservation Laboratory (USWCL) of the U.S. Department of Agriculture-Agricultural Research Service (USDA-ARS) proposed in 1990 to several federal and state of Arizona, USA, agencies the idea of developing and testing a managed change process in an irrigated agricultural area. The Management Improvement Program (hereafter referred to as MIP) is a structured, broad-based methodology that draws from a range of existing managed change techniques.

The USWCL's interest in applying the MIP arose from the realization, in the course of their irrigation research in the 1970s and early 1980s, that the way in which water was delivered to the farm did not support improved irrigation technologies. It also became apparent that factors internal and external to the farm were preventing the successful adoption of irrigation technologies and that a better understanding of these constraints was needed to strengthen research and extension efforts. It was expected that a process like the MIP would help improve water resource management in an area by better match-

ing the on-farm irrigation systems with overall farm management needs and with the irrigation district's water delivery system capabilities.

In response to the USWCL proposal, this group of agencies agreed to participate in and support, both financially and in-kind, such an effort and established an Interagency Management Improvement Program Coordinating Group (IMIP CG)<sup>1</sup> to oversee the project. Expected outcomes of the project were (1) a better understanding of the process itself, including potential benefits and constraints; (2) development of a generic MIP model and guidelines for its effective use in any agricultural setting; and (3) development of institutional support to ensure the MIP's continued availability. As a means of meeting these goals, they proposed that the MIP methodology be refined through repeated applications to a number of settings in the western U.S. The first application of the MIP in the U.S. was conducted from 1991 to 1994 in the Maricopa-Stanfield Irrigation and Drainage District (MSIDD) in central Arizona.

The objectives of this paper are twofold. The first is to provide background information on the MIP, including its objectives and structure and a discussion of its methodological origins. The second is to provide an overview of its first application in the U.S., including a description of the area in which the demonstration was conducted, a chronology of the application, identification of broad outcomes, and discussion of major lessons learned as they apply to future applications. Companion papers provide more details on the demonstration project. Dedrick et al. 2000, describe the Diagnostic Analysis phase of the MIP and provides an account of the application. The performance of individual agricultural system components is discussed in Clemmens et al. 2000; Wilson & Gibson 2000; and Bautista et al. 2000a. These articles also discuss how the understanding of the agricultural system was translated into individual or collective initiatives aimed at improving the sustainability of the agricultural system. Finally, Bautista et al. (2000b) analyze the lessons derived from the demonstration project and provide recommendations for future applications of this process.

## **Description of the Management Improvement Program (MIP)**

### *Structure*

The ultimate goal of the MIP is to improve the performance of the agricultural system. This goal, generally, can be achieved primarily through improved management of all components of the system. A key MIP premise is that complex agricultural management problems often require coordinated changes in on- and off-farm practices, in the delivery of productive resources (e.g.,

water) or services (e.g., technology transfer) to farms, or in the interaction between farms and other stakeholders (e.g., regulatory agencies) or among these other stakeholders. Hence, shared understanding, communication, coordination, and collaboration among key participants are the major themes of the MIP. In the MIP framework, performance is defined broadly in terms of profitability of the agricultural enterprise and long-term productivity of the natural resource base. The specific methodology for assessing such performance is application-dependent and, therefore, consistent with the interests and objectives of the stakeholders.

The MIP's goals are accomplished through two thrusts: first, by carrying out an initial cycle of the three-phased improvement process (fig.1) under the guidance of a process management team. This team, which is identified as the MIP Management Team, may vary in membership but must combine technical and managerial expertise. While carrying out the MIP, a second thrust must focus on creating a multi stakeholder organization that becomes the management unit for the MIP and continues to manage the MIP process on into the future. While this management unit will enhance the ability of all stakeholders to achieve improved performance, future focused efforts may need outside experts to help in guiding the process. Such support could be provided through the involved organizations. Members of this local organization will have an enhanced knowledge of the area's agricultural system and the interrelationship among its components. They also will have developed an understanding of the need for a managed change process as a tool to diagnose and improve the performance of the complex agricultural system.

The MIP's three phases feed into one another, may overlap in some respects, and are therefore less discrete than the diagram might suggest.

- During the Diagnostic Analysis (DA) Phase, an interdisciplinary field study is conducted to assess the current performance of the irrigated agricultural system and to explain the causes of both high and low performance. This understanding, when combined with the knowledge and experience of the stakeholders, provides the foundation on which all subsequent activities are built.
- During the Management Planning Phase, farmers and relevant organizations develop a shared understanding of the DA results and expand their understanding of the performance of the system. With this foundation, participants jointly identify performance improvement opportunities and develop managerial and technological improvement plans. In addition to problem-solving activities, participants are also involved in strategic planning and team-building activities, which are essential for the long-term sustainability of the process.

- During the Performance Improvement Phase, the involved entities implement the management plans; establish processes for monitoring, evaluating, and adjusting as required; and develop mechanisms and guidance for continuing the effort subsequent to the formal end of the externally led portions of the MIP (i.e., one or more complete cycles of these three MIP phases).

#### *Methodological origins*

Strengthening the viability and competitiveness of complex organizations is at the heart of managed change or organizational development (OD) processes. Managed change processes evolved from laboratory training and survey research and feedback techniques, the Action Research approaches pioneered by Lewin (1952) and others (Beckhard & Harris 1987; French et al. 1983; Nadler 1977). They have enjoyed widespread use in both the public and private sectors in Western Europe, North America, and Japan, where they have been widely credited with increased productivity, enhanced customer service, and improved products and services. Over the years, they have been packaged under various rubrics such as socio-technical systems and, more recently, Total Quality Management and Reengineering. These processes have also become an integral component of donor-supported institutional strengthening efforts in lesser developed regions of the world. Examples can be found in the literature of applications of OD techniques to agricultural and natural resource management, health and sanitation, small business, agricultural research, and political institution development projects.

In essence, the various OD methodologies advocate similar principles, among them (Heilpern and Nadler 1992):

- The need for organizations to properly identify and focus on client needs.
- Participation of individuals at all relevant levels of the organization in the identification, planning, implementation, and assessment stages of the process.
- Systematic data-gathering, evaluation, and feedback.
- Development of clear agreements among the various levels of the organization and/or between the organization and the clients through consensus-building.

Organizational development techniques aim to influence individual and organizational behavior through active participation in a change process. Following are some of the benefits that have been attributed to these collaborative approaches:

- Participants develop a strong feeling of ownership of the collected data and interpretation of results.
- Individuals at the operational levels of an organization become empowered by participating in the decision-making process. This empowerment increases their commitment to the success of the organizational change and their willingness to take the associated risks.
- The resulting programs are value driven, meaning that they take into account the values, priorities, and attitudes of participants.
- There is a synergistic effect when individuals with diverse professional expertise and personal experiences work in teams.
- Small group dynamics can have a dramatic impact on individual learning and behavior.

Nadler and Tushman (1992) define a framework for organizational analysis that is useful in understanding how a managed change process would be applied to a complex organization. These authors view the organization as a transformation process defined by inputs, the organizational components, and outputs. Work (tasks and processes), people, the formal organizational structure, and informal structure (or organizational culture) are the organizational components. Input to the system is provided in the form of strategy, which is in turn defined by the environment or setting, i.e., the resources, opportunities, and the organizational history. Output is measured in terms of goal attainment, productivity, and adaptability to the setting. A managed change process may involve promoting changes in one or more of these aspects of the organization. In some cases, the change may focus on developing new strategies that are more compatible with the current context or with anticipated changes in that context. Changes in work may imply changes in the sequence of activities required to carry out the strategy. For the individuals, changes in responsibilities and individual attitudes may be needed. The managed change process may affect the formal organization through development of new work arrangements and relationships and the informal organization through the changes in group values and beliefs. Finally, an important element of the change process is a change in output, with greater attention to customer satisfaction. Tools of the change process include training, development of measurement and feedback systems, technical support, improved communications, and establishment of a system of rewards and recognition. In their experience, such a process typically takes five to seven years to institute.

#### *Managed change in irrigated agriculture*

The application of managed change concepts to agricultural development is not new. A prime example is the Farming Systems Research and Develop-

ment (FSRD) approach (Shaner et al. 1982; Norman 1995), which has been used for many years to promote technological development and diffusion. The FSRD approach combines elements of systems analysis, action research, and user training and participation in the technology development process. It has been used extensively with small, low-income farms in dryland farming regions, where farming conditions and practices are generally very diverse, to develop technologies that meet specific user needs.

In irrigated agriculture, OD processes have been applied to the development of functional user-controlled water delivery organizations. In many parts of the world, planning, construction, operation, and maintenance of irrigation water delivery projects have been traditionally the responsibility of national bureaucracies. According to various reports produced over the past twenty years, many of these government-controlled systems have a low record of performance, largely because the responsible bureaucracies have proven unable or unwilling to provide the level of service required by water users (Jones 1995; Merrey 1996). Extensive programs have taken place in Latin America, Asia, and Africa in recent years to devolve the operation and maintenance responsibilities of irrigation distribution systems to users (Bagadion & Korten 1991; Johnson et al. 1994; Vermillion 1997). International organizations (World Bank, USAID, Asian Development Bank, FAO, International Irrigation Management Institute, and others) have played a significant role in this development by advocating and supporting the application of participatory processes to irrigation projects (Lattimore & Fowler 1988; Brinkerhoff & Goldsmith 1990; Cernea 1991; Uphoff et al. 1991).

In the literature review, conditions similar to those embedded within the MIP have been identified. Tang (1992) and Vermillion (1996) analyzed the characteristics and performance of various water user organizations created to manage irrigation systems. Ostrom (1992) and Perry (1995) examined factors that contribute to the sustainability and performance of these water user organizations and provide specific recommendations for designing such organizations. In a recent publication, Meinzen-Dick (1997) reviewed various models for user participation in management of delivery systems in various parts of the world. The author identifies three factors as critical to the success of these efforts: the presence of institutional organizers and training programs, the role of partner bureaucracies, and a set of enabling conditions (e.g., water institutional and legal framework; financial, technological, and market infrastructure). The enabling conditions encompass most of the recommendations provided by Ostrom (1992) and Perry (1995). Implicit in the first condition is that water user groups may lack the organizational skills or culture needed to carry out their management responsibilities. These skills and attitudes need to be developed or reenforced and this almost always

requires external resources. The second condition implies that, as part of the change process, partner organizations may need to redefine their relationship with those user groups and with each other. This may in turn require internal changes in work (tasks and/or procedures) and in the formal and informal organization as defined above. The last condition highlights again the need for using a holistic approach for promoting change in the irrigated system. Furthermore, it also points out that partnerships need to be established at high levels of the organization. These partnerships could then help promote changes in institutions, laws, financial arrangements, market infrastructures, etc., if such changes were critical to the sustainability of the irrigated system and congruent with the local or national interests.

In the Western U.S., water users historically have played a prominent role in the development and management of irrigation systems. Much of the earlier irrigation development in the western U.S. was done with private or community funding (NRC 1996). While federal, state, or local governments have been the sponsors of major irrigation development in this century and retain the ownership of the main works (dams and main canals), users generally own and manage the distribution systems and help pay for operation and maintenance costs of the main works. Users have also played an important role in the development of the institutional framework under which water is managed in the western U.S. Both the National Research Council (NRC 1996) and the Council for Agricultural Science and Technology (CAST 1996) observed that there are numerous previous and current examples of participatory efforts, with the cooperation of irrigators and other stakeholders, aimed at solving some existing water resource management problems.<sup>2</sup>

The above cited reports state, however, that changes in the formal institutions and the “irrigated agricultural culture” are needed to address current as well as future issues that will be created by population expansion and the corresponding development of new water interests. Thus, these reports recognize that addressing future broad problems in water resource management, at a project or even watershed scale, will require existing water related organizations, including agricultural water purveyors, to adopt new roles and develop new institutional arrangements. While these reports are not specific on how these changes in irrigation institutions and cultures can be crafted, it is likely that the same elements proposed by Meinzen-Dick (1997) (i.e., institutional organizers or some type of organizational training, proactive partner bureaucracies, and changes in the enabling conditions) would have to play a role in such a process.

*Precursors to the MIP*

A direct predecessor to the MIP is the Water Management Synthesis Project II, an irrigation development program conducted primarily by Colorado State University and the University of Maryland researchers with sponsorship from the U.S. Agency for International Development and the Consortium for International Development (Lattimore & Fowler 1988). Using systems analysis, action research, and team-building tools, the project aimed to improve the performance of large irrigation systems. The process used interdisciplinary teams in the assessment and planning phases. The project also sought to develop training methods for building the interdisciplinary teams, comprising foreign and local experts, responsible for carrying out the technical aspects of the project. One of the outcomes of this project was the Diagnostic Analysis, a method for diagnosing the performance of irrigation systems (Clyma & Lowdermilk 1988). Another outcome was the development of an action-planning approach specific to irrigation management – the Management Training and Planning Program (Jones & Clyma 1988). In both the Diagnostic Analysis and Management Training and Planning Program, a facilitated team management process is used to carry out all strategic planning, team-building, and monitoring activities. This team management process, called Team Planning Methodology (TPM, Levine 1989), was created at the Development Program Management Center of the U.S. Department of Agriculture and then refined and expanded in applications to development projects in various African and Asian countries.<sup>3</sup>

Two members of the team that guided the MIP application in central Arizona were involved in these earlier methodological developments. In the mid-1980s, the third author, along with management planner support from the University of Maryland's International Development Management Center (some of whom facilitated preliminary events to explore MIP use in Arizona) led a series of efforts in Pakistan and other countries to link the earlier development model to management planning and training concepts similar to those used in the TPM. The focus was implementing performance improvements. The fourth author was a consultant to these efforts as well as one of the primary developers of the TPM and its expanded use to guide such long-term development efforts.

## **Overview of the MSIDD-Area Demonstration MIP**

### *Linkage to the U.S. Water Conservation Laboratory and the Arizona application*

USWCL researchers began to investigate the performance of irrigation water delivery systems in the early-1980s (Clemmens & Dedrick 1984). Their motivation, as stated in the introduction, was to develop a better understanding of how delivery system performance impacted on-farm water management. This research experience led to a sabbatical visit to the USWCL by the third author in 1988–1989, during which time a mini-Diagnostic Analysis (the first phase of the MIP) was conducted in an irrigation district in southwest Arizona (Palmer et al. 1991). At this point, ARS decided to consider the study of the MIP as an ARS research program. The product would be a systems-based agricultural management process that would, first, yield a system-wide interdisciplinary understanding of the performance of the agricultural system (on- and off-farm and their interface) and, second, guide the process by which the system's performance would be improved.

### *Comparative conditions between the proposed MIP application in the U.S. and earlier work*

The initial design of the MIP for use in central Arizona was based directly on the earlier experiences with its various source methodologies. In particular, its overall purpose – improving water resource management – and general structure were closely related to these prior efforts. At the same time, it was recognized that the setting for the Demonstration MIP would be significantly different from that under which the methodology had been developed and tested. Furthermore, it was also acknowledged that project scope and strategic approach would depart somewhat from previous efforts because of the following differences.

### *Overall length and scope*

The Development Model advocated through the Water Management Synthesis II project is simply a process of problem assessment, planning, and implementation. These phases can be carried out more than once, as a series of improvement cycles. Although the assessment and planning elements of the process had been tested overseas, there had not been an opportunity for successive implementation of all three phases. Action-planning activities after problem assessment were carried out over a limited period of time leading to initial plans or agreements among involved organizations. Imple-

mentation of the plans was left to the interested parties without involvement of the sponsoring organizations.

For central Arizona, it was planned at the outset to implement a MIP with all three phases as a single program succeeding each other through the implementation phase, and continuing long enough to establish a foundation for future management improvement with the participation of relevant stakeholders.

*Initial project development, mandating, and resourcing*

WMSII projects were parts of international development efforts initially approved through multi- or bilateral negotiations between donors and governments. During negotiations, the level of governmental supervision and the nature of local participation were often mandated. The bulk of financial support was from international donors, part of which was to cover costs of consultants and some support for ministries and other entities involved. In some instances, relatively large funding amounts were available to achieve specific needs or goals for an area, which often were accomplished by implementing extensive civil-works programs.

The central Arizona MIP application was a voluntary effort. The application was prompted by the desire of a research organization, the USDA-ARS U.S. Water Conservation Laboratory, to test a managed change methodology in a U.S. setting. Partners, including an irrigation district willing to host the demonstration, were identified as part of the project. Mandates to allow agency personnel to participate in the demonstration project were secured with each agency individually, and funding to support the MIP process was provided entirely by those entities directly involved. No funds were provided to implement and support identified programs that evolved from the Diagnostic Analysis and Management Planning phases. In future applications, which would target pre-identified needs or goals specific to an application area, it is expected that funding for programs as well as for the MIP process would be provided by the benefitting parties.

*The number and nature of stakeholder organizations*

There are some significant differences as well as similarities in the nature of stakeholder organizations overseas and in the U.S. The main difference is the central role of a government agency in the management of the water projects overseas. In the overseas applications, water user organizations had a short history or had to be developed as part of the project. In the U.S., irrigation districts are farmer-controlled and have legal characteristics similar to those of municipalities. As for governmental organizations, the number of organizations is large in both cases. Although in overseas settings there are often fewer separate authorities (usually national and state, but also regional)

to which those involved in the program were accountable, many functional divisions existed (e.g., extension, credit, fertilizer, seed, research) with various conflicting and often complicating agendas. In the U.S. there is a wider range of separate sources of authority, some local, some state, some national. In some instances, the missions and priorities of these organizations overlap. In the U.S., local levels of federal and state organizations are often highly autonomous in delivery of their programs and have some conflicts in agendas and approaches.

#### *Farmer-centeredness and farmer participation*

At the conceptual level, full farmer participation in the planning, implementation, and review of programs is an essential component of the approach. This goal has proved to be elusive in its realization. In many overseas applications, farmer participation was limited to the required involvement of a few pre-identified farmer leaders. In the U.S. application, farmer representative organizations were already in place, namely the district's board of directors and other advisory boards with jurisdiction over areas broader than the district area. A condition of conducting the demonstration MIP, and one that was met, was to involve farmers in all phases of the demonstration process and to maintain a balance between farmer and organizational representation in all activities.

#### *Farm size and access to technology*

Farms in central Arizona are large relative to those in the overseas applications and have access to a far greater range of technological, infrastructural, and financial support. They also tend to have a specialized organization, in some cases with hired managers making the day-to-day operational decisions. The implication of this difference is that in the U.S. application, while there might be fewer farmers overall to deal with, their numbers would comprise a larger part of the farmer population. Also, it became apparent that in addition to the farmers, farm staff would have to be studied during the diagnostic phase of the project.

#### *Setting up the Demonstration MIP*

In 1990, the USWCL proposed to federal and state of Arizona agencies that a demonstration of the MIP methodology be carried out in Arizona. A planning workshop was convened in April of that year to explore potential purposes, intended outcomes, and implications for such an effort. Initial scoping of the MIP's objectives and approach was done with support from individuals with previous experience with the application of the Water Management Synthesis II program development model. Initially, the partner agencies agreed that the

broad purpose of a MIP application would be “to evaluate water resources management in irrigated agriculture with respect to economics and environmental quality; identify opportunities for improvement in farm, district and government operations; and implement and evaluate appropriate changes.” Expected outcomes of the process were a better understanding of problems and opportunities for improving water resource management, identification and implementation of alternatives at both the farm and water delivery levels, improved communication and collaboration among system stakeholders, and identification of needed changes in agency programs. Later, however, the emphasis of the MIP was broadened from a water management focus to an irrigated agricultural focus, which included all farming activities, not just water. These agencies formed the Interagency Management Improvement Program Coordinating Group (IMIP CG) to provide general guidance to the process, and at the group’s request, USWCL agreed to lead the demonstration.

Between April and October 1990, agreements were developed to fund the start-up of the project. At the same time, exploratory discussions were held with several irrigation districts in Arizona that might be interested in participating. From the beginning, it was determined critical for the success of the project that irrigation district participation would be voluntary. Finding an application site proved challenging as irrigation districts expressed concerns about time and financial costs to their organizations, uncertainty about the process itself, and suspicion that it was a veiled effort by government agencies to meddle in their internal affairs. District attitudes were reflected in such comments as, “My district may have a common cold, but it does not need treatment for cancer,” and “Why would I want to work with all those people who make my life miserable?”

In December 1990, the Maricopa-Stanfield Irrigation and Drainage District (MSIDD), through its board of directors, agreed to participate as the demonstration project site. During the initial exploration for a demonstration site, the IMIP CG had not considered MSIDD to be an adequate demonstration project site; its infrastructure was new and state-of-the-art, and no operational problems were readily apparent. However, the IMIP Coordinating Group later recognized that MSIDD would provide a good case study for analyzing water management under high water cost conditions. Although district management was apprehensive about “being under a magnifying glass,” they perceived some potential benefits, primarily, the value of getting people to work together (see LeClere et al. 1994, for a discussion of the district’s reasons for participating and their expectations).

Following the agreement by MSIDD to participate in the Demonstration MIP, the USWCL formally established a management team (the MIP Management Team).<sup>4</sup> The team numbered four at the outset and increased to

five in November 1992. Of these, two (later three) were USWCL employees, including the first author as team leader. Two were consultants hired to be part of the team. Consistent with the MIP methodology's interdisciplinary approach and its dual thrusts of technical and managerial change, MIP Management Team members were selected to bring diverse disciplines, backgrounds, and experiences to the team. Planning was initiated in early 1991, and the MSIDD-Area MIP began with a start-up workshop in April 1991.

#### *The MSIDD-area setting*

The MSIDD serves approximately 35,000 ha of irrigated farmland in central Arizona. The climate in the area is arid, with an annual average rainfall and temperature of about 200 mm and 21°C, respectively. Agriculture is highly dependent on irrigation as the annual average reference evapotranspiration is an order of magnitude greater than the average annual rainfall. At the time that the MIP began, cotton was produced on approximately 85% of the farmland and surface irrigation systems were used on nearly all of the farms. The MSIDD distribution system was built in the late 1980s to deliver water from the Central Arizona Project (CAP) and from district-owned groundwater wells. MSIDD operates as an arranged delivery system in that water deliveries must be requested at least 24 hours in advance. When the Demonstration MIP was initiated, farmers were experiencing high costs for water from the newly on-line Central Arizona Project Canal, depressed commodity prices, lower yields overall, and severe pest infestations. MSIDD was faced with declining revenues because of farm closures as well as pressures from the "take-or-pay"<sup>5</sup> provision and political complexities of the CAP (discussed in detail in Wilson & Gibson 2000). More details on the MSIDD-area agriculture, the district's facilities, and the regional agricultural economy in early 1991 are provided in Clemmens et al. 2000; Bautista et al. 2000a; and Wilson & Gibson 2000.

#### **A chronological overview of the demonstration MIP in the MSIDD area**

The three phases of the MIP (Diagnostic Analysis, Management Planning, and Performance Improvement) were implemented over roughly a three-year period, beginning in April 1991 and ending in January 1994: (1) Diagnostic Analysis, April 1991 to March 1992; (2) Management Planning, March 1992 to January 1993; and (3) Performance Improvement, January 1993 to January 1994. Although the Performance Improvement Phase formally occurred from January 1993 to January 1994, some change activities were initiated at the time the Diagnostic Analysis results were being shared with various

entities during the fall of 1991, several months before the DA Phase “officially” ended. Further, implementation of various programs by the MSIDD MIP Coordinating Group continued after January 1994. A brief overview of the demonstration activities follows.

### *The diagnostic analysis phase*

In April 1991, a three-day workshop was convened to launch the demonstration project and to develop specific plans for the Diagnostic Analysis Phase. The objectives of the Diagnostic Analysis were identified as documenting the performance of irrigated agriculture in the MSIDD area and the specific factors contributing to important areas of high and low performance. The study was to focus mainly on the farms and the irrigation district itself, while also describing learnings about the roles and perceived effectiveness of support and regulatory agencies. As noted earlier, although the initial intent was to focus on water issues, it became apparent that water management could not be isolated from the management of other resources, including natural, financial, other agricultural inputs, and human resources. Clearly, economic, organizational, and legal constraints also were influencing farm and district operations. From this holistic perspective, major emphasis was given to understanding the economic, managerial, and technological interrelationships among the farms, MSIDD, and other agencies.

An interdisciplinary team was recruited to plan and carry out the Diagnostic Analysis study. This team, called the DA Team, was led by the first author and was composed of individuals representing the areas of on-farm irrigation, irrigation delivery systems, social-organizational, agricultural economics, and agricultural productivity.<sup>6</sup> Important to the DA Team’s success was that two of its members, in addition to their technical expertise, brought local experience and knowledge to the DA through their service with local agricultural support organizations. The Team’s initial tasks were to specify overall plans for data gathering, analysis, and synthesis, and to develop the related instruments and processes. In addition to aiding the DA Team in the development of its research approach and data collection instruments, members of the MIP Management Team also contributed to the data collection and analysis process.

Between June and August 1991, the DA Team interviewed 25 farmers, 30 MSIDD employees, and the 9 members of the board; analyzed data; and developed an initial draft of the findings. Preliminary drafts of the findings were reviewed by the DA Resource Team<sup>7</sup> and by MSIDD’s staff and board. More details can be found in Dedrick et al. (2000).

Following Action Research principles (See Dedrick et al. 2000, for more detailed discussion of the role of Action Research in the DA Phase.),

MSIDD's staff and board members, eight of whom were farmers, were provided with initial drafts of Diagnostic Analysis findings for their review and comment. These early findings were not well received by the district's management, who felt that the findings were unfairly critical and contained information they already knew. In fact, these initial exchanges with MSIDD management were confrontational and nearly terminated the demonstration project. Subsequent exchanges between MSIDD management and the MIP Management and DA Teams resulted in correction of any inaccurate information or data in the report, rewording to maintain the substance of conclusions while providing a more neutral tone, and appropriate emphasis on performance strengths that needed to be included. MSIDD, on the other hand, came to understand and appreciate that DA findings were comprehensive and necessarily document both known and new information about performance. While difficult and time-consuming, these discussions ultimately engendered trust among key players and strengthened the credibility of the report and MSIDD's commitment to the MIP.

Farmer involvement in the Action Research process of the DA, in addition to the MSIDD board participation, occurred through interviews of 25 farmers and a dozen various farm employees, and review of the report prior to its official release during a general meeting held in March 1992. During that meeting, farmers were updated on MIP progress and DA findings; they were provided with an overview of the upcoming planning phase; and their participation was solicited in those planning activities.

Volumes I and II of the DA Report were published in March and July 1992, respectively (Dedrick et al. 1992a and b). The report was used as a starting point and basic reference for developing the shared understandings essential to the MIP's planning phase.

### *The Management Planning Phase*

The Management Planning Phase began with a start-up meeting in late March 1992, followed by two, week-long workshops in April involving stakeholders. The first workshop provided a transition from the DA study to the planning process. The DA findings were presented to the MSIDD community and the broader agency audience, including agency representatives with state or regional (for federal organizations) responsibilities. Facilitated discussions were organized among small groups of participants to develop a common understanding of the performance of irrigated agriculture in the area, as reported by the Diagnostic Analysis, and to identify performance improvement opportunities to be explored in subsequent MIP planning activities. The small groups included both farmers and organizational representatives. These exchanges, in which farmers voiced their concerns and organizations provided

information on their missions and programs, were important steps that led to a mutual understanding, not only of issues identified by the DA, but among stakeholder groups, that would be needed as planning and implementation moved ahead. The second workshop participants included a smaller group of farmers, who were invited because of their interest in participating in the planning process, and agency representatives with direct program responsibilities in the district area. These individuals further analyzed the improvement opportunities identified earlier and began the process of identifying appropriate technologies and programs and developing strategies to address them.

Based on the discussions of the DA findings in these workshops, two specific programs were identified as priorities. One dealt with interagency delivery of on-farm support and the second addressed the impacts of overall water costs and assessments. Following a series of more specific planning sessions, these two programs were initiated during the spring of 1992.

While the workshops produced some initial collaborative activities, many of the high priority opportunities for improvement identified by the DA were not being addressed. Further, the MIP Management Team was concerned that the complexity of the economic conditions potentially was keeping farmers and agencies from committing to work on many of these opportunities. Thus, over the next few months, a more general planning effort was initiated, beginning with the participating organizations' review of improvement opportunities generated during the first stage of the management planning phase. From these reviews they identified intra and interorganizational performance improvement opportunities that could be addressed. Area farmers provided similar input in a June 1992 meeting. These responses from organizations and farmers were used as a starting point for a broad-based planning meeting convened in August 1992. Participants at the planning meeting included MSIDD-area farmers and representatives of involved organizations.

At that meeting, three workgroups were formed: Overall Coordination and Management of MIP-Type Activities; On-Farm Profitability and Sustainability; and Water Costs, Assessments, and Related Issues (Table 1) Each workgroup's membership included farmers and participating agency representatives. The first workgroup was formed to address the critical issue of the long-term sustainability of the MIP process in the MSIDD area following the formal conclusion of the demonstration. The group focused on (1) developing its own institutional framework in preparation for assuming responsibility for MSIDD-Area MIP guidance, and (2) developing and initiating programs aimed at strengthening overall communication and improving coordination of services delivered to farmers. This group eventually became known as the MSIDD Coordinating Group. A local farmer became the group's first leader in September 1993.

Table 1. MSIDD-Area MIP workgroups and associated programs.

Workgroup	Program	Description
Overall Co-ordination and Management of MIP-Type Activities	MSIDD-Area MIP Coordinating Group Development	The MIP Management Team, along with representatives from MSIDD-area farmers and associated agencies, developed the institutional framework for a Coordinating Group in preparation for assuming responsibility for MSIDD-Area MIP guidance.
	MSIDD-Area Wide Information Sharing	The Coordinating Group developed activities focusing on information sharing and problem identification and resolution. Example activities include: a newsletter, town meetings (open forums), and resource library.
On-Farm Profitability and Sustainability	Farm Specific Profitability and Sustainability	The farmer and the farm are approached as a management unit with assessment and improvement focused upon inter-organizational strategies to identify and address important soil and water management issues.
	Farmer-to-Farmer Networking	Farmer initiated and led, the program involves a series of informal meetings in which farmers learn from other farmers.
	Reduction of Flow Fluctuations in Irrigation Laterals	The program will focus on developing, implementing, and assessing automatic control schemes in open channels to reduce water delivery fluctuations to the farm.
	High and Low On-Farm Water Usage	From the Diagnostic Analysis of the MSIDD area, wide variations in water application volumes not correlated with cotton yields were identified. This unexplained variability provides an opportunity to identify its specific causes and then develop appropriate on-farm management practice changes.
	Commodity Diversification in the MSIDD Area (Including the Potential for Minimum or No-Tillage Practices Program)	The goal of this program, over time, is to contribute to the profitability and sustainability of Central Arizona's irrigated agriculture by facilitating successful diversification of commodities produced by farming enterprises in the area. The program is seen as longer term and as requiring significant initial effort to develop an appropriate strategy to achieve its potential.

*Table 1.* Continued.

Workgroup	Program	Description
Water Costs, Assessments, and Related Issues	Reducing the Level and Impact of Water Costs and Assessments	The Water Costs and Assessments Workgroup focuses primarily on issues dealing with Central Arizona Project water and its impact on the MSIDD area and on related activities underway in the state to manage and use its Colorado River entitlement. The Workgroup also addresses overall management strategies to reduce water costs and strengthen the use of special water rates to support winter cropping and crop rotation.

The latter two workgroups were extensions of the planning efforts that had been initiated following the workshops earlier in the planning phase. The On-Farm workgroup focused on management and technological change opportunities identified in the Diagnostic Analysis, which resulted in various programs (Table 1). The workgroup used interdisciplinary and interorganizational teams which all included local farmers. The third workgroup provided an initial demonstration of the value of interorganizational planning and of the understanding and trust that had already developed among MIP participants. Representatives from MSIDD, state and federal regulatory agencies, and farmers came together in a series of meetings to clarify a federal government proposal dealing with the “take-or-pay” provisions of CAP irrigation districts’ water contracts and to explore MSIDD’s response to that proposal. The discussion process provided MSIDD with an opportunity to use the expertise made available to them through the MIP.

The MIP Management Team provided guidance and support to the three workgroups as they carried out their tasks. Based on the Team Planning Methodology approach (Levine 1989), meetings were structured to carry out the strategic planning activities and to train the teams in interdisciplinary planning techniques. These meetings were carried out over a period of ten months. The result of these planning efforts was the series of proposals that are listed in Table 1. As noted in the table, some of the proposals dealt with technology transfer and natural resource management issues while others dealt with improving communication and coordination among MSIDD farmers and between farmers and agencies.

*The Performance Improvement Phase*

Although the formal initiation of the Performance Improvement Phase occurred in early 1993, as noted earlier, some improvement activities – some planned, some spontaneous – began during the DA. Some of these activities continued through a couple of seasons, some were adopted as permanent procedures by involved organizations, and some proved to be a one time effort. Also, during this implementation phase, control of the MIP process was transferred from the MIP Management Team to the MSIDD Coordinating Group. Involvement of the Coordinating Group over the prior year in developing leadership had prepared them for this transition. The formal transfer process occurred first in the form of a program review meeting in November 1993, during which the local Coordinating Group reviewed each of the eight MIP programs underway or being developed in collaboration with those involved in the programs, followed by a formal Demonstration MIP closure meeting in January 1994, chaired by the MSIDD Coordinating Group. Participants in the closure meeting included area farmers, MSIDD staff and board members, and representatives from agencies that were involved in or had originally mandated the demonstration project. At this meeting, the Demonstration MIP's progress and status were reviewed, initial evaluation findings were presented, and input for the continuation of the MIP effort was solicited from the meeting participants.

As part of the action research component of the demonstration MIP, a formal study was initiated in mid-1993 to evaluate its impacts. Initial planning for the evaluation was done by the MIP Management Team with input from both groups providing oversight to the demonstration project, namely, the IMIP Coordinating Group and the MSIDD Coordinating Group. A three-member team<sup>8</sup> was established to carry out the evaluation. The team included, as a leader, an independent consultant with extensive experience in evaluating multi-stakeholder change efforts, and two members of the MIP Management Team. In view of the long and complex nature of the Demonstration project, members of the MIP Management Team were included on the team in this study to provide insights and understandings to the interpretation of the data. The major data-gathering technique was structured individual and group interviewing. The study focused on identifying the impacts on three distinct groups of participants, namely the farmers, the irrigation district, and support/regulatory agencies. Similar to the process used during the Diagnostic Analysis Phase, preliminary drafts of the evaluation findings were provided to organizations for their review and to obtain feedback. A final report was published in October 1994 (LeClere et al. 1994).

Subsequent to the publication of the Evaluation Report (LeClere et al. 1994), the MIP Management Team held separate meetings, from November

1994 through February 1995, with those agencies most central to ongoing MIP programs in the MSIDD area and/or to future applications of the model.<sup>9</sup> The purpose of the meetings was to review the evaluation results, including key impacts of the Demonstration MIP on the MSIDD area and learnings about the process itself, and to consider how the respective organizations could use the evaluation findings, both inter- and intraorganizationally, to benefit from continuing application of the MIP methodology.

MSIDD Coordinating Group activities mostly have focused on educational and informational opportunities that arose (e.g., related to financing, pest control, and severe weather), and the group has provided some programmatic supervision. The MIP Leadership Team in February 1996, coincident with transition to a second farmer-leader of the Coordinating Group, assisted in a program review and subsequent identification of actions the Coordinating Group would continue as part of their program delivery. On occasion, authors from the USWCL have continued to consult with members of the Coordinating Group. A third farmer-leader of the MSIDD Coordinating Group took office in January 1997. Currently, the MSIDD Coordinating Group, per se, is inactive; however, many aspects of the MIP effort are continuing in the MSIDD area, and impacts of the MIP are evident through the influence of individual MIP participants within organizations outside the MSIDD area. While the MIP Management Team no longer exists in an official capacity, USWCL members of the team continue to monitor MSIDD MIP activities and impact.

### **Demonstration MIP outcomes**

The following discussion is based on findings reported in the Evaluation Study (LeClere et al. 1994). This study, as noted above, was carried out toward the end of the three-year formal part of the intervention. Additional data are included that have been collected since through formal and informal contacts with stakeholders. In discussing these outcomes, two contextual factors need to be noted. First, the MSIDD-Area MIP was undertaken primarily to develop and test the MIP methodology and not in response to specific needs of MSIDD. Resources for managing the demonstration were provided by the IMIP partners but no resources were provided for making on- or off-farm infrastructural improvements, implementing technology transfer programs, carrying out interorganizational activities, or for monitoring the progress of proposed activities. As a result, of the various activities proposed during the planning phase, only those that could be supported by the interested organizations under their existing program budgets were eventually carried out. Second, the period during which the demonstration project was carried out

proved to be one of crisis in the central Arizona agricultural economy. While not its original intent, the demonstration project had to be responsive to these circumstances and their implications for program priorities.

### *The MIP as a learning process*

The action research elements of the process proved to be valuable tools for creating the common understanding of the agricultural system that must be achieved among stakeholders as the basis for identifying, planning, and implementing needed change. This understanding was created first through the interdisciplinary approach employed to collect and analyze data and was greatly strengthened through the interaction between the MIP Management Team and participants, including farmers and agency representatives. The synergistic effects of small group discussions were frequently observed throughout the process. Participants often described the process as a “revelation” in terms of knowledge gained with respect to farming operations, the activities of support and regulatory agencies, and the complex interdependencies in the agricultural system. More important, this new understanding induced changes in behavior and practices by individual stakeholders.

An example of the significance of the interdisciplinary understanding created by the process was the analysis of economic conditions in the MSIDD area. DA findings were incorporated in a policy study commissioned by the state of Arizona in 1992 (Wilson 1992). These studies contributed to policy and legal changes at the state level that allowed MSIDD and other stakeholders in the service area of the Central Arizona Project to find some initial solutions to the adverse economic conditions (Wilson & Gibson 2000). Another example involving farmer attitude toward a district policy is described later.

### *The irrigation district*

A key expected outcome of the MIP application was better coordination of the irrigation district’s water delivery services with the farmers’ needs. The Evaluation Study (LeClere et al. 1994) reported a positive impact in this regard. As noted earlier, no significant infrastructural changes were anticipated given the newness of the district. Still, MSIDD improved water measurement and control. In addition, it made organizational changes by adopting a new organizational structure, instituting formal mechanisms by which employees and clients could provide feedback, and by adopting measures to enhance client service. It is important to note that most of these changes did not occur as a result of activities suggested during the planning phase, but rather, spontaneously by MSIDD in direct reaction to findings as they developed. As an

example, criticisms expressed in the early drafts of the DA report appear to have played a significant role in changes adopted by MSIDD before the report was completed. A year after the conclusion of the Demonstration Project, members of MSIDD's board of directors identified the improvements in the quality of the district's water delivery service as the most significant MIP impact.

The responsiveness of the district to the early DA findings indicates that MSIDD, prior to the MIP, was already a strong, functional organization concerned with providing quality water delivery service. There were indications that the role of the organization, as perceived by management and the board of directors, further broadened during the course of the MIP, becoming more of a water manager rather than solely a water retailer. After having gone on-farm for the first time as part of an interdisciplinary assistance team, the MSIDD watermaster commented, "It's hard to help if you don't know what the customer does with the product." The district's initial view that they would not make any changes that involved spending "one more dollar" changed when they recognized the complexity of economic interdependencies within the MSIDD area and, consequently, that spending one dollar could bring in two when farmers prospered. Examples of policy changes include adopting an aggressive lowered winter water pricing program to encourage the growing of small grains (see next section), paying one year's tax assessments associated with the development of the irrigation district, providing water deliveries to farmers who were delinquent with their tax payments (and, therefore, ineligible to receive water), and the formal adoption of delivery policies that district management had been reluctant to support openly.

### *The agencies*

Figure 2 both identifies and categorizes the entities that participated in some way in the Demonstration Management Improvement Program in the MSIDD Area. Generally, they are public sector entities. As profitability and sustainability of irrigated agriculture are most directly in the hands of the area's farmers, and as they are the intended focus of the missions of the others involved, the farmers are at the center of the schematic. Each of the concentric circles around the farmers shows agencies or organizations whose nature of involvement in the area's agriculture is generally similar. Moving outward from the farmers, the first circle connects organizations or entities directly supporting agriculture in the MSIDD area; the second connects organizations with primarily regulatory missions although they may also have some support functions; and the furthest circle includes the two research and/or education organizations that were involved.



Figure 1. Schematic diagram of the Management Improvement Program.

The schematic was developed during the transition from the Diagnostic Analysis to the Management Planning Phase and has served as a useful symbolic guide during the Demonstration MIP. It was used extensively to

- Keep the MIP focused on the farmers and the need to impact irrigated agriculture;
- Remind participant organizations of the support and/or regulation associated with irrigated agriculture and the inherent potential complexities this may cause the farmers;
- Symbolize and remind various entities, by depicting each organization's relationship to farmers (i.e., distance from the center) and to each other (i.e., linkage to each other depicted by the dashed lines connecting the organizations), of their shared purpose and involvement with agriculture in the area;
- Identify additional entities that might be involved in the MIP and serve as a point of departure for determining appropriate levels of representation from involved entities, consistent with the activity to be undertaken; and
- Serve as a point of departure for the development of strategies for organizing and coordinating resources from among the entities in ways (i.e., intra- and interorganizationally) that may leverage the impact on irrigated agriculture.

All entities shown in Figure 2 participated in some events or activities associated with the MSIDD-Area MIP.

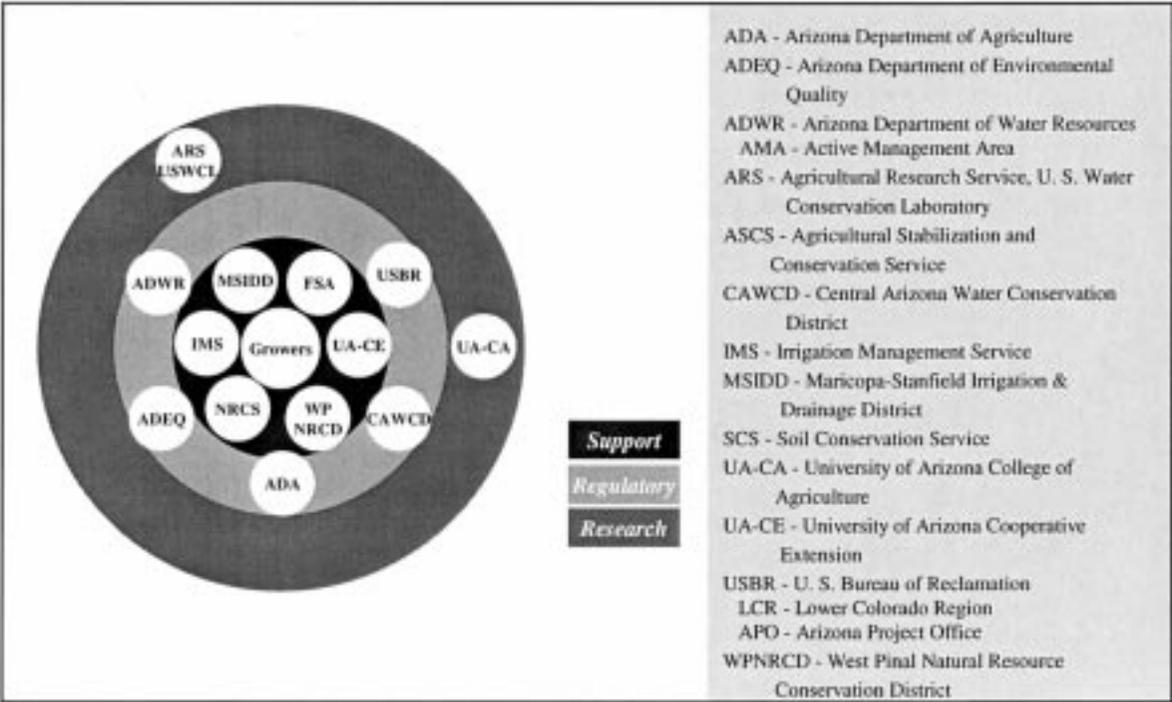


Figure 2. Schematic representation of entities involved in irrigated agriculture in the MSIDD area.

From the agency standpoint, the MIP had its greatest impact on individuals who played active roles during the process, e.g., DA team members, members of planning activities, or individuals involved in the implementation of MIP related activities. Benefits ranged from an improved understanding of the agricultural system, to improved networking with other agency representatives and farmers, and in some instances, changes in their individual programs or practices. These changes in programs and practices have had impacts outside the district area, as a result of the interaction between these agency representatives and non-MSIDD farmers.

It is important to observe that the participation of all agency representatives was added to the demands of their everyday responsibilities. In at least one instance, these added activities had negative consequences to an individual whose commitment to the project took time from other responsibilities.

The new working relationships that developed through the MIP among agencies and between the agencies and the district were highly valued, and there is significant anecdotal information to support this assessment. The following are examples:

- The MSIDD Coordinating Group development, implementation, and operation embodied the most significant relationships that evolved from the MIP.
- Early in the process, MSIDD management and directors expressed reservations about the involvement of regulatory agencies. Later, these same individuals expressed disappointment when representatives of these organizations, whom they had learned to trust, withdrew from the process because of changes in their work assignments.
- The formation of a county-wide discussion group involving representatives from governmental agencies, financial institutions, and other stakeholders, which emerged in 1994, was a significant spin-off of MIP activities by some of the discussion group. The purpose of the group was to exchange information on individual organizational activities relevant to the county's agriculture. The emergence of this group was influenced, to a significant degree, by the activities of the MSIDD Coordinating Group where, as part of their activities, farmers, district, and agency representatives regularly exchanged information on activities relevant to the district area as part of their meeting agenda.
- Interagency technology transfer programs were carried out in 1992 and 1993 on seven farms. The outcomes of such activities reported by the farmers were significantly improved irrigation and nutrient management

practices. The on-farm activities were not institutionalized by involved agencies, thus, were not continued after 1993.

- A new-farmer information strategy was used in 1994 in which agency representatives and farmers met with new farmers in the area to provide them with relevant information on their new property. Farmers who had previously farmed the property and/or future neighbors were invited to those meetings. The targeted farmers found the approach useful. From the participating agencies' standpoint, an important outcome was the development of a practical approach to recruit farmer expertise for assistance in their resource planning efforts with other farmers. This effort was used for two years, after which time the agency representative who initiated it was reassigned to a new position outside of the area.
- The "Reduction of Flow Fluctuations in Irrigation Laterals" program that was proposed as part of the MIP, Table 1, has been underway since 1996. It is a collaborative program between the District, researchers (Albert J. Clemmens, member of the DA Team, and the second author) from the U.S. Water Conservation Laboratory, and a private company. The program focuses on developing, implementing, and assessing automatic control schemes for the open channel canals to reduce water delivery fluctuations to the farm.

The next-to-last bullet illustrates how continuity of programs was negatively impacted by changes in agency personnel, including participation on the MSIDD Coordinating Group. This adverse impact was anticipated and the MSIDD Coordinating Group planned carefully for a thorough on-boarding process for new representatives, but the on-boarding process was not rigorously applied.

Impacts at the agency-wide level for those organizations that participated in the MIP effort were not expected. However, at least in one instance, the guiding principles of the MIP (e.g., customer involvement, inclusion of all participants in planning and implementation of programs, assessment of impact) are being applied. The senior author, at the USDA-ARS agency level, is leading a change process to redefine the national research portfolio throughout the agency. The outcomes of the change process include improved research program coordination, improved communication throughout the organization among research scientists and program managers, and will empower the agency's customers as they provide input to inform the agency's research program. The process also will empower the agency's scientists through their active involvement in the development of research programs that respond to customer input.

Further, in 1997 at the agency (Agricultural Research Service) and departmental (USDA) level, the MIP was recognized by the Charles Valentine Riley Memorial Foundation as one of four cooperative projects from over 100 considered Nation-wide with the most potential to clarify the confusion about roles of agricultural support agencies and to foster organizational structures and procedures conducive to partnerships. The MIP, with the other three projects, was presented to U.S. departmental and agency representatives in Washington, D.C., in 1998.

### *The farmers*

The demonstration MIP was carried out during a period of high anxiety for many MSIDD farmers as they saw their livelihood threatened by factors which they deemed mostly beyond their control. This attitude became particularly evident during the initial planning phase workshop, when a farmer repeatedly stood and demanded changes in water pricing to the attending agency managers as a solution to all of the farmers' economic problems. Still, the MIP Management Team was able to recruit a core group of farmers to participate in the ten-month planning phase and in the subsequent implementation of the proposed activities. Further, there is evidence that a large number of farmers learned and benefitted from the process.

One way in which farmers benefitted was that many developed a better understanding of the district's policies and, in some cases, become aware of delivery rules that were not well publicized. Some of these changes in understanding actually provided opportunities for reducing costs as illustrated by the following example.

In 1991, the district charged \$100 for water order changes outside their regular service hours, 7:00–15:00. Though the policy was approved by the district's board of directors and was adopted for sound economic reasons, farmers resented the inequities created by the fee and were making every effort to avoid paying it. Of the 25 farmers interviewed for the DA, only two were paying for water order changes outside of regular service hours, and some farmers even opted to overirrigate at a cost higher than the fee. The impact of the fee was discussed in detail in the DA Report and during the early planning phase meetings. These findings did not lead to changes in this policy although the district publicized other policies that had not been officially supported until then. Indications are, however, that farmers' attitudes changed somewhat during this period. This change is reflected first in the farmers' perception of improved delivery service following the MIP (Le Clere et al. 1994) and an increase in the number of farmers paying for special services (e.g., water order changes outside the regular service hours).

*Table 2.* Winter water-pricing program and associated small grains and cotton areas planted in the MSIDD area from 1990 through 1994.

Year	Crop Area, 1000 ha		Water Cost (\$/DAM)	
	Cotton	Total Small Grains	Summer (\$)	Winter (\$)
1990	20.4	0.5	54	34
1991	16.5	0.7	45	34
1992	15.4	1.6	40	25
1993	11.9	4.0	40	25
1994	9.8	8.1	40	27

Another way in which farmers benefitted was a better understanding by the district of the role of the water delivery service as an economic factor in the agricultural system economy. This understanding directly led to the formation of a workgroup to analyze ways to attack the cotton monoculture problem identified by the DA study and adoption of water pricing policies to combat the problem. In 1991, the virtual cotton monoculture had developed in the district because of the high water cost; low price for small grains that had been traditionally rotated with cotton; and more stringent credit conditions, including a lack of flexibility by lenders to finance rotational crops. Lack of crop rotation was suspected to be a factor in declining cotton yields and increased insect infestations in the area. The district was already reducing the price of water during the winter season with the goal of defraying operating costs during periods of low water demand. In 1992, prices were further reduced (thus indirectly subsidizing farmers) to encourage planting of winter grains. The price reduction successfully promoted increased grain acreage in the area as shown in Table 2. External circumstances, specifically, improved grain prices and credit availability, further stimulated grain production in the area in the latter years.

In addition to learning about district policies and rules, farmers also learned about agency programs with which they were unfamiliar. And, as the district learned more about farm irrigation delivery needs, some agencies' representatives learned more about how agency programs influenced farm planning and strategies. Statements such as "I didn't know [agency] had such a program" were made during the planning phase meetings by farmers. The response of one local agency representative to such a statement was to adopt a program to inform farmers about his agency's activities and changes in programs. Opinion surveys conducted both within MSIDD and in a neighboring

district suggest an improvement in perception by farmers of program delivery by agencies in the area during this period.

General farmer participation in the demonstration MIP was high; about forty out of a total population of about eighty farmers participated in various aspects of the MIP process. Of these, nine played significantly active roles during the planning and implementation phases. These farmers represented a progressive farming element in the MSIDD area and would be likely to facilitate adoption of improved management practices and technology. The participating farmers were not directly reimbursed; therefore, indirect benefits to farmers had to be present to interest them in participating. According to the farmers who played active roles, these benefits were in the form of learning from and networking with fellow farmers, district management, and agency representatives. These individuals also expressed a strong sense of duty toward their community. It should be noted that their participation was voluntary, and on their own time.

For the general farmer population, participation and interest appear to be issue-specific. A farmer-to-farmer discussion group, involving about 20 farmers, was created in 1993 and presently continues to meet. The purpose of the group is specifically to discuss agricultural practices. Anecdotal data indicate that farmers have exchanged valuable information that has led to subsequent changes in farming practices. MIP-sponsored town halls featured an emergency meeting in response to a flood in the area (first town hall, held in 1993), and in 1994, provided a mechanism to form a pest control district with the objective of coordinating pest control management practices in the area. The MSIDD Coordinating Group continued to organize open-house type meetings during the 1994–1996 period that focused on technological and financial issues of interest to area farmers. All of these events were well attended.

#### *Sustainability of the MIP Process*

At this writing, more than five years after formal conclusion of the Demonstration MIP, discussions with key participants indicate that the sustainability of the process is uncertain. Farmer interest in the Coordinating Group, as an institution, has waned, and with diminished farmer interest, agency interest has likewise lessened. Reassignment of original agency CG representatives has contributed to declining agency interest. Still, individuals, especially farmers, are concerned about the possibility that the process may die and with it the mechanism by which they can get relevant information and discuss issues of common concern. In its charter, the CG defined its function much more broadly. In addition to providing “a unique open forum for information sharing and problem identification and resolution,” the CG intended to fo-

cus attention on “short- and long-term matters, on- and off-farm, and on the impacts of broader economic, policy, and political conditions on the area’s irrigated agriculture.”<sup>10</sup> In addition to their desire to see the CG continue, farmers also value the MIP farmer-to-farmer meetings where they meet in an informal setting to exchange information and ideas.

## **Conclusions**

The MSIDD experience confirmed expectations that the MIP would be a valuable managed change process in an agricultural setting. The assessment of the process, based on both quantitative and qualitative data, indicates that the demonstration accomplished its main objective, to test the MIP as an agricultural change process. In so doing, a number of other objectives were accomplished, namely, to induce changes in understanding in the agricultural system, to foster better relations and collaboration among stakeholders, and to promote changes in management practices by farmers, district, and other agencies with a stake in the agricultural system.

The duration of the demonstration project was three years. Based on experiences described in the literature, five to seven years are necessary to institute significant management, technological, social, and cultural changes. Part of the extensive time needed is associated with stakeholder unfamiliarity with complex management change processes. Managers of future MIP-type change processes in agricultural settings must be mindful that some participants will not understand the need to allow time for the change process to evolve, particularly the social and cultural aspects.

As with any project or program, assessment of the process is a necessary part of an application. Understanding (of each other and of the issues) and cooperation among stakeholders are essential for managed change to be carried out. These are examples of impact that must be assessed, and their assessment generally is based on qualitative data. Further, as the MIP process unfolds, organizations may undertake unilateral changes (e.g., organizational or policy) that have positive impacts but are difficult to quantify. Such changes may, in some cases, result indirectly from the MIP. On the other hand, impacts of programs that address problems identified through the MIP process may be quantifiable, particularly those involving technological change.

Addressing the issues of time to effect change and assessment of the MIP process should be part of the planning and educational process the MIP Team undertakes with stakeholders or potential stakeholders relative to expectations. It must begin early and continue as new participants (individuals or organizations) enter the program.

As noted earlier, the central Arizona Demonstration MIP was a voluntary effort. Mandates to allow agency personnel to participate in the demonstration project were secured with each agency individually, and funding to support the MIP process was provided entirely by those entities directly involved. No funds were provided to implement and support identified programs that evolved from the Diagnostic Analysis and Management Planning phases. In future applications, pre-identified needs or goals specific to an application area would be targeted, with funding for programs as well as for the MIP process being part of the strategic planning activities for the MIP.

## Notes

1. Entities represented were Arizona Departments of Water Resources and Environmental Quality, The University of Arizona Cooperative Extension, USDA-Natural Resource Conservation Service (NRCS, formerly Soil Conservation Service), USDA-ARS-U.S. Water Conservation Laboratory (USWCL), and U.S. Department of Interior-Bureau of Reclamation (USBR). Representatives of two additional agencies, the Arizona Department of Agriculture and The University of Arizona College of Agriculture, joined this group later.
2. A widely publicized example is the CalFed process, through which federal, state of California, and California water users are trying to find practical solutions to the water quality problems in the Sacramento-San Joaquin Delta area caused by the operation of the federal and state water projects.
3. TPM has been adapted as a standard team building tool by many USAID funded projects, including the Water and Sanitation for Health program (WASH) (Liebler 1994).
4. MIP Management Team membership was constituted to provide leadership over broad areas – conceptual, managerial, relational, and technical – while infusing the overall process with vision. In practice, this charge translated into directly developing and facilitating MIP events, maintaining ongoing communication with participants, addressing specific concerns and problems as they arose, developing and publishing MIP-related documents, and maintaining records and files. Also, as an element of the overall Action Research approach to the IMIP effort, the MIP Management Team held periodic multi-day planning sessions to assess the MIP's progress, to plan and replan as needed, and to identify interim lessons learned that seemed relevant to the present and future MIP applications. The authors of this paper made up the MIP Management Team with Dedrick leading the team and Clyma (MIP specialist) and Levine (management/team planning specialist) serving as consultants to the program.
5. The federally-mandated "take-or-pay" provision of MSIDD's contract with CAWCD was to be invoked in 1993. Under this provision, MSIDD was committed either to buy its full allocation of water (approximately 140,000 acre-feet annually) or pay the fixed operation and maintenance costs of \$15.90 per acre-foot (U.S.\$) for the difference between the allocated and purchased amounts.
6. The DA Team included Albert J. Clemmens and John A. Replogle, Water Control: On-Farm and Water Control: Delivery, respectively, USDA-ARS USWCL; Richard D. Gibson, Social-Organizational, The University of Arizona Cooperative Extension, Pinal County; Paul N. Wilson, Economics, Dept. of Agricultural Economics, The University of

- Arizona; and Ralph E. Ware, Agricultural Productivity, USDA-NRCS, Casa Grande, Arizona, District Office. MIP Management Team members Dedrick, Clyma, Levine, and Rish augmented the DA Team by participating in and assisting with data collection, analysis, and synthesis.
7. An interorganizational group of supporting and involved organizations that provided guidance and oversight to the DA process. Entities represented were: MSIDD, Arizona Departments of Water Resources and Environmental Quality, USDA-NRCS and USDA-ARS USWCL, USDI-USBR, West Pinal Natural Resource Conservation District, Irrigation Management Service, and The University of Arizona Cooperative Extension. The Resource Team was augmented by two outside consultants – a sociologist and an economist.
  8. Evaluation team members were William E. LeClere, Organizational Development Specialist, Luray, Virginia; and Bautista and Rish, USDA-ARS USWCL.
  9. The MIP Management Team held closure meetings with the MSIDD board of directors, MSIDD management staff, MSIDD MIP Coordinating Group, USDI-USBR, USDA-NRCS, and Arizona Department of Water Resources (ADWR).
  10. Excerpt from “The Charter of the MSIDD-Area MIP Coordinating Group,” February 19, 1993.

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