

Practical Application of Systems Models and Action Research: Training and Organizational Renewal

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ABSTRACT

Transportation agencies, like most public organizations today, are undergoing rapid and major changes that challenge their ability to adapt and function effectively. The University of Massachusetts/Institute for Governmental Services, training unit for the Massachusetts Department of Public Works (MDPW), has been helping MDPW meet the challenge of organizational survival and renewal. The use of systems models to understand the impact of change on MDPW, guide development of strategies for providing training to an organization in transition, and help MDPW personnel rebuild their capacity to cope with change is discussed. The Kotter organization dynamics model, a descriptive model that trainers used to gather information about MDPW and analyze the impacts of change on MDPW as an organizational system, is reviewed. The organization states model, a prescriptive model that proposes that trainers and managers must modify their usual problem-solving strategies when working with an organization in crisis, as was MDPW, is outlined. Using the models helped trainers establish the credibility and responsiveness of the program and secured the support of MDPW managers. To develop and deliver training, trainers used action research as their operational approach to working with MDPW experts, managers, and line staff and with FHWA officials. Action research stimulated organizational problem solving and change and assured that training met changing needs. How trainers have been delivering training to MDPW has been as important to organizational renewal as what training is offered.

Transportation agencies, like most public organizations today, are undergoing rapid and major changes that challenge their ability to adapt and function effectively. Meeting this challenge requires that organizations learn new survival skills and that training units adopt new approaches to delivering training and educational programming. It is increasingly important that training units help their organizations develop the ability to adapt, solve problems, and take more control of their own future.

The University of Massachusetts/Institute for Governmental Services, training unit for the Massachusetts Department of Public Works (MDPW), has been helping MDPW meet the challenge of organizational survival and renewal. Staff employed systems models to assess MDPW, to guide development of strategies for working with an organization in transition, and to maintain the training staff's ability to respond to MDPW's changing needs.

It is shown that, through an action research ap-

proach to planning and delivering programming, training staff are not only improving employee performance but are also helping MDPW develop problem-solving skills. How staff have been delivering training has been as important to organizational renewal as is what staff have been programming. Applications of the models and results of using the models in MDPW are presented.

BACKGROUND

Maintaining responsiveness to an organization in transition is a challenge to any training unit. It is a particular challenge when the organization and the unit are both undergoing major changes. Brief profiles of the MDPW, a changing organization, and of the Institute for Governmental Services of the University of Massachusetts, an external training unit, will provide a context for the applications of systems models and action research methodology.

MDPW

During the past 30 years MDPW has undergone significant organizational changes. Changes in national highway program trends and in federal and state influences on MDPW have significantly affected the organization's mission, staffing, resources, and power. In response to changing national trends, MDPW's mission now focuses on maintenance of highways and bridges and reconstruction of critical arteries. In the 1980s the organization has fewer resources, fewer employees, and less decision-making power than it had in the 1950s. Vignettes of MDPW's evolution follow.

1950s and 1960s

In the 1950s, in response to a national emphasis on construction of the Interstate system, MDPW's mission stressed the construction of state highways. To accomplish this mission, the organization operated with a comfortable budget and a full staff of 4,500-5,000 people. The organization was proud of its capacity to build highways and attract engineers to adequately paid, professional, and secure positions. Through the 1960s MDPW was powerful. The nature of its federal funding gave autonomy from state budget problems; the department made its own decisions and set its own course with little or no direction from the governor's office. By the late 1960s, however, public groups were banding together to challenge the location of major highways, and the federal government was beginning to stress a balanced transportation program. This meant that highway divisions had to share funding with public transit divisions.

Changes in staffing patterns occurred in the 1950s. Since that time the department has hired few young people at entry-level positions. Civil service restrictions and competition from private sector organizations and other state departments of transpor-

tation (DOTs) offering higher wages contributed to this change. As a consequence, MDPW has lost the age diversity that allows an organization to maintain its adaptability.

1970s

By the 1970s the national highway program emphasis on highway construction was coming to an end. Budget cuts left MDPW with 3,400 employees, the majority nearing retirement. When consultants took over many tasks, ostensibly to save money, employees resented the change, believing that MDPW personnel should continue doing the tasks and maintaining their skills. The power balance changed as the governor's office, working through a strong state secretary of transportation, set policy and MDPW responded.

1980s

During the 1980s the nation's highway departments have been experiencing major changes related to an increasing emphasis on public transit, rapid deterioration of highways and bridges as a result of high volumes of traffic, and increasing need to plan replacement of significant numbers of retirees. In addition to coping with these issues, MDPW has felt the impact of Proposition 2 1/2, the state's local property tax limitation law, and of the turnover of all railroad bridges, many seriously deteriorated, to the department.

Changes in MDPW during the last 3 years have been particularly severe. The department has lost its sense of purpose and its decision-making power and has experienced budget and critical staffing cuts that affect the organization's capacity to respond to federal mandates and to critical service needs.

There is growing recognition that maintenance of highways and bridges should be the department's priority. Although there is some federal funding for the maintenance-focused Four-R program, it is not sufficient; this is a major change from the well-funded emphasis on highway construction.

In 1981 budget cuts eliminated many resources and forced termination of about 1,100 employees and demotion with pay cuts of 500 more. As employees, primarily young newcomers, were terminated, the average age of personnel rose to 57. The cutbacks and loss of critical skills made it necessary to contract out more work at all levels of operation. Morale, already low, plummeted as the department lost its decision-making power to the governor's office. Despite the layoffs and constant shifting of personnel necessitated by demotions, the MDPW was expected to continue doing its job.

Currently, department managers are working with a new governor, a new secretary of transportation, and the FHWA to rebuild and refocus the organization. Slowly MDPW is rehiring to achieve a staffing level of 3,123. By hiring 100 junior civil engineers with engineering degrees, the organization hopes to increase its technical competence and decrease the average age of employees, presently 57 years. Managers and federal highway officials are concerned with planning for replacement of retirees with critical skills and with developing adequate staffing of critical functions.

In 1984 the department will face many new challenges including the orientation and integration of new employees; a move to a new, modern, central office building equipped with new information processing technologies; and a realignment of the organizational structure.

Institute for Governmental Services

The Institute for Governmental Services links the educational resources of the University of Massachusetts with practitioners in public agencies to improve the functioning of state government. For more than 13 years the institute has delivered management and supervisory training to state agency personnel, carried out research, and produced publications.

In 1980 the MDPW obtained FHWA funding and contracted with the institute to manage, develop, and deliver statewide education and training programs for MDPW employees at all levels. Institute staff, experts in training and education technology, were to serve MDPW as an external training group, maintaining their own office at the university.

The staff, working with MDPW advisors and state community college personnel, established an Associate in Civil Engineering Technology degree program at several of the colleges. In response to a training need assessment conducted at MDPW in the 1970s, staff also delivered a series of generic management and supervisory training programs. The offerings reflected the institute's emphasis on traditional supervisory courses.

The new training program experienced a great deal of resistance from MDPW managers and employees who were not accustomed to either organized department-wide training programs or supervisory training. Training had previously been developed by various in-house training officers who put together sessions on technical subjects for their own divisions.

In late 1980 MDPW advisors indicated that a focus on technical and engineering skills would serve current needs better than the supervisory training. They wished to continue some supervision courses so that all managers and supervisors would be trained, but requested a change in emphasis for the next year. In early 1981 MDPW established three advisory committees that identified training needs in supervisory, clerical, technical, and engineering areas.

The new focus signified major changes for training staff. In offering supervisory training, staff drew on their own expertise and delivered courses that they had designed largely on their own. Presentation of technical skills courses required a different type of expertise and a different mode of working with MDPW. To develop skills courses, staff would have to work closely with MDPW technical and engineering experts. Thus the style of operation became a highly participative one.

This change and two others, which occurred about the same time that MDPW was experiencing organizational upheavals, significantly affected the evolution of the training program. In late 1981 MDPW assigned a new monitor to work with the institute training team. The new monitor adopted a problem-solving approach in working with staff to realign programming with MDPW's changing needs. Training staff have relied on their monitor's guidance regarding sensitive issues and policy matters, on his sense of the MDPW organization, and on his excellent support. By 1982 this monitor and the program were located in MDPW's Personnel Department; this increased the potential for closer ties with other personnel functions.

Also in late 1981 training staff began involving their FHWA monitor as a training resource person. Because FHWA was conducting an adequate staffing study of MDPW, the FHWA monitor had valuable ideas to contribute about critical skill needs and departmental units that required strengthening. In 1982 this monitor began attending training programs and, in some cases, participating in the classroom activ-

ities. He has been very helpful in planning and resource identification roles.

SYSTEMS MODELS AS PROGRAM DEVELOPMENT TOOLS

To plan and work effectively with an organization undergoing rapid change, training staff needed some models for examining the complex events. Models provide frameworks for understanding and interpreting vast amounts of data and complex interrelationships. Systems models enable trainers to gather information about organizations, examine information and events systematically, understand the impact of events on each other, and develop appropriate plans or strategies for a given organization or situation.

The institute training team employed two systems models to (a) analyze MDPW, (b) develop strategies for working with MDPW and for maintaining flexibility and relevance of programming, and (c) plan modifications of their programming and role as trainers. Further, they used the models to maintain perspective on organizational events and changes and recognize opportunities for helping MDPW stabilize itself. The two models were (a) Kotter's organization diagnosis model that examines organization dynamics and the impacts of change and (b) an organization states model focused on characteristics of organizations in decline and crisis.

In the following sections the models are described, how training staff applied the models is explained, and changes the staff made as a result of using the models are reviewed.

Kotter Organization Dynamics Model

Training staff used the Kotter organization dynamics model to understand MDPW as it went through a critical period and to reassess the organization as it emerged from the depths of a crisis. Applying the model as a diagnostic tool, staff developed a picture of MDPW and prescribed appropriate actions and stances for the training team vis-à-vis MDPW. The components of the model are described next.

Outline of the Model

The Kotter model provides a framework for collecting and examining data over a wide range of organizational dimensions. As shown in Figure 1, this systems model employs six structural elements and a set of key processes (1). It explores the dynamic interactions of the elements and the key processes and sets forth criteria for assessing organizational effectiveness.

This descriptive model is most useful as a tool for identifying organizational strengths and weaknesses; planning changes; and identifying the systemic consequences of changes over short, moderate, and long time periods. The model proposes the following six elements:

1. Employees and other tangible assets: the size, number, and characteristics of an organization's employees, plant, offices, tools, equipment,

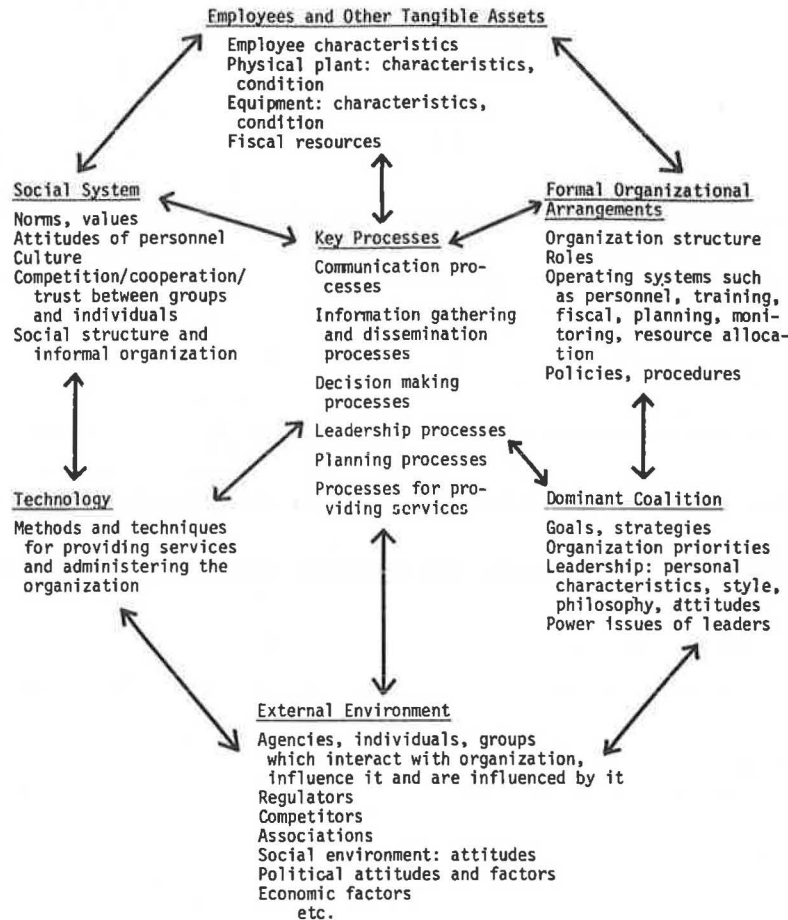


FIGURE 1 Organization dynamics model adapted from Kotter (1).

land, and money. Includes such factors as employee age, ability, and training.

2. Formal organization: the formal systems (such as hierarchy, structure, roles, personnel functions, training, fiscal functions, resource allocation) that regulate the organization's employees and machines.

3. Dominant coalition: objectives and strategies, characteristics of leadership, and relationships among those employees who engage in policy making and oversight of the organization. Examines power issues.

4. External environment: includes task environment individuals or agencies such as suppliers, clients, competitors, regulators, and associations that affect the organization's products and services. Also includes wider environmental factors such as public attitudes, economy, politics, social views, and so on.

5. Technology: includes major techniques or technologies (such as maintenance management systems, computers, patching techniques, and so on) that employees or machines use to carry out organizational processes.

6. Social system: involves the organization's culture with its norms, values, attitudes, and relationships among individuals and groups.

The key processes, the central element in this system, affect the six elements described and are affected in turn by the condition of each element. The key processes include the organization's infor-

mation processes such as communication (How do people communicate? Is communication effective?), decision making (Who makes decisions and how?), information gathering and dissemination (How do managers gather information from employees or from the public? How do they inform people? How do they use information they gather?), and energy transformation processes such as service-providing strategies (e.g., snow and ice control, maintenance). The effectiveness of the key processes is a crucial indicator of the organization's short-term operational health.

Figure 2 shows some examples of MDPW data in the Kotter model categories. The data shown might be typical of issues confronting many state highway departments.

By collecting information about each of the elements and the key processes, a trainer can develop a basic picture of an organization at a given time and can identify potential problem areas, strengths, and weaknesses of the organization and of the trainer's knowledge of the organization.

A basic picture of the organization, although helpful, is only a beginning. By examining the impact of structural elements on each other (for example of environment, employees, technology, and social systems), it is possible to observe the dynamics of an organization as a system, to identify systemic problems, and to forecast the consequences of creating changes in any part of the system. For example, as a result of external legislative decisions or changing state revenues, the organization may have lost employees with the critical skills re-

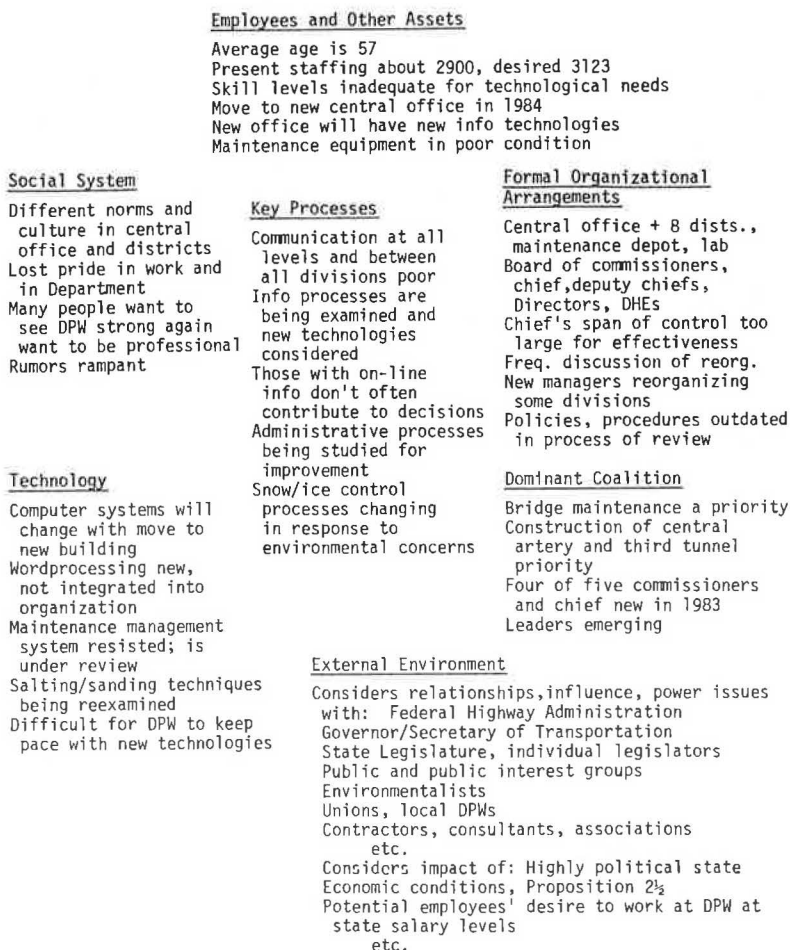


FIGURE 2 Examples of MDPW data in the Kotter model.

quired to operate the type of technology or equipment that the organization uses to achieve its goals. This may affect the organization's social system, creating an image of the organization as weak and ineffective and lowering morale. Trainers may be aware of such interrelationships, but the model makes them explicit and frequently identifies connections or consequences an observer might otherwise overlook.

Kotter proposes three time frames for understanding organizational dynamics, short, moderate, and long run:

1. Short run (present time to 6 months): In short-run dynamics, the cause-and-effect relationships among the six structural elements and the key processes are the main focus. Although each key process can affect each element and vice versa, the total system of structural elements influences any one cause-and-effect relationship. For example, if the dominant coalition does not have good decision-making skills or if external authorities take over decision-making responsibilities, the key process of decision making would be weak and ineffective. The consequences of this relationship would be reflected in all other elements: in a poor image of the organization by employees and the public, in weak organizational systems and poor accountability measures, and so on.

2. Moderate run (6 months to 6 years): In the moderate run, the alignments or consistencies between the six structural elements alone are of major concern. Here the issue is whether the structural elements are aligned (consistent, congruent) or nonaligned (in opposition). For example, if the organization does not develop an adequate staff of trained, skilled employees who can implement the technologies the organization must use, employees and technology will be nonaligned and the organization will be spending its resources and energy ineffectively. Nonalignments sap energy from the organization and ultimately interfere with the success of short-run improvement strategies. Serious nonalignments over a long time can result in decline or demise of the organization; this condition typifies the MDPW.

3. Long run (6 to 60 years): In the long run, the major concern is again with the six structural elements. This time, however, the model focuses on the adaptability of the elements and their relative potency as driving forces within the organization. The driving force is that element that seems to have most influence on the growth and development of the organization over a period of time. Factors in the external environment have become the driving force for many public agencies. It is important to ask whether the organization needs to develop a different driving force to become more effective or regain its health. Perhaps the dominant coalition should take back control of the organization from the external environment.

In the long run, it is important that organizations have flexible, adaptable elements to respond more effectively to changes and turbulence. When an organization's elements become nonadaptable or rigid, the organization is less likely to be capable of adjusting to new demands. Some examples of rigid elements are outdated or poorly maintained technology and equipment; lack of trained personnel; lack of age and talent diversity in staff; and failure to revise mission, roles, and procedures. After assessing the adaptability of elements, it is necessary to improve the flexibility of rigid elements.

The Kotter model can help trainers and managers identify problems and forecast the consequences of

solutions or changes. When trainers or managers develop strategies for organizational improvement, whether it is training, structural change, or introduction of new technologies, they must examine the consequences of the strategies for the short-run relationships and the alignments and adaptability of elements. They must assure that they are not creating serious new problems with their strategies.

Use of the Model at MDPW

Using the Kotter model to learn about MDPW, institute training staff developed a systematic and realistic view of the organization and of the training team's capacity to serve it effectively. They observed why the organization was in crisis, noted the complex interrelationships underlying the crisis, identified where the power and influence for change lay and what might occur as changes were made. These observations suggested strategies for working with MDPW.

As MDPW emerged from its most critical period, training staff reassessed their picture of the organization. They determined that their training strategies were helping MDPW develop and maintain the adaptability of some of its structural elements, for example:

1. Employees: increasing job-related skills through training and education programs.
2. Dominant coalition: increasing awareness of effective management and supervisory techniques and practices.
3. Technology and equipment: increasing maintenance skills and potential for improved maintenance; increasing knowledge of the use of technology.
4. Social systems: providing support to managers and supervisors during layoffs, checking rumors and feeding back facts to people in the training programs, improving employee self-perception and morale by helping employees develop new skills.

Training staff will continue to use this model to gather information about MDPW, reexamine the organization as it continues to change, and plan appropriate training strategies. Staff have introduced the model to FHWA officials and some MDPW managers as a tool to use as MDPW rebuilds and renews the department.

Organization States Model

After examining descriptive data about MDPW as an organizational system, training staff employed a prescriptive model to identify the appropriate behavioral strategies to use with an organization in a particular operational state. They applied a new organizational states model to characterize MDPW's operational state and the team's state and to forecast the strategies the team could most effectively use with MDPW.

The organization states model provides a framework for identifying organizational environment and behavior characteristics that typify certain states of organizational evolution and suggest intervention strategies. The model proposes three states or conditions--status quo, problem solving, and fabric crisis--that may characterize an organization at particular points in its evolution. Each state is represented by a continuum of stages ranging from positive to negative. Organizations may evolve from one stage to another and from one state to another.

Each organization state is characterized by a definable type of organizational environment and be-

havior. The characteristics have implications for trainers and managers because strategies that work in organizations in one condition may be inappropriate or ineffective in organizations in another condition. This suggests that trainers need to determine what state and stage their organization is in and what it is moving toward. The status quo, problem-solving, and fabric-crisis states are characterized next.

Status Quo

The status quo state typifies bureaucratic organizations that may need to change their operations but prefer to stay the same, fear change, or suffer from inertia. Organizations in this state respond in primarily reactive ways to environmental demands and problems. Under stress, the organization may adhere to rules, procedures, and rigid accountability measures as a means of maintaining control of its environment. Employees may see the organization as stable, predictable, sterile, rigid, slow to respond, and outdated.

Problem Solving

In contrast, an organization in a problem-solving state actively responds to internal and external demands. The organization uses problem-solving methodologies to cope with and control opportunities; problems; and difficulties of growth, operations, or existence in a particular environment. Organizations in this state have the capacity and energy to examine themselves, develop corrective strategies, and plan for their future. Employees might describe their environment as flexible, adaptable, creative, unstable, and unpredictable.

Fabric Crisis

Organizations in the fabric-crisis state are in some stage of decline or disintegration. In the most severe stages of this condition, the fabric of the organization--its mission, structure, norms, and culture--is being torn apart. A large number of the organization's vital systems are in questionable repair, and the organization is fighting for survival. Overwhelmed by its own deterioration, the organization lacks the energy or capacity to redirect or realign itself. Employees might describe their environment as paralyzed, demoralized, out of control, or dying.

The model proposes that organizations can move from either status quo or problem solving into crisis. A status quo organization might move into crisis because, to use Kotter's terminology, it lost its adaptability and capacity to respond and so was overwhelmed by new demands or changes. A problem-solving organization might move into crisis because it tried to adapt or change too many aspects without returning to a stage of status quo to stabilize the change. Even a healthy problem-solving organization may be overwhelmed by massive change.

An organization in the early stages of fabric crisis might enter problem solving as a means of renewal; or it might restabilize and accept a constant crisis state as its status quo. Trainers and managers must learn how to help their organizations move from one stage to another and from one state to another.

Crisis State

Because many public agencies are facing crisis conditions, the model focuses on the crisis state. It suggests that employees in organizations in crisis and the organizations themselves suffer deep morale problems and loss of energy and capacity to help themselves. The process of organizational decline reflects the stages of death and dying described by Elisabeth Kubler-Ross: denial, anger, bargaining, depression, and acceptance (2).

When employees and organizations are experiencing denial, anger, or depression, rational problem-solving and planning techniques normally used by trainers to solve organizational problems are not, by themselves, effective. The environment is an emotional not a rational one. Thus for organizations in a crisis state, strategies must include nurturance; development of support systems for individuals and work groups; and, at a later stage, rebuilding the capacity to respond and take control of the situation. The role of the trainer is, at first, that of counselor, listener, and healer. Then, to prevent employees from wallowing in negativity and paralysis, the role changes to reality counselor and problem solver.

As institute training staff applied the organization states model to MDPW and to their own team as an organization, it was apparent that MDPW had been moving through stages of fabric crisis for some time, but the team functioned in a problem-solving state. To increase their effectiveness, training staff modified the rational problem-solving strategies they normally used and drew on their experience as counselors and nurturers. They continually reassessed MDPW's state and adapted their strategies to help the department move to a healthier stage or state.

RESULTS OF APPLYING SYSTEMS MODELS

The training team used the Kotter and organization states model to modify their own roles and to reorient the training program. As a result of the changes they made, the team created a more effective and responsive program and gained support of the organization for their activities.

Modification of Training Staff Roles

During the period of rapid change and declining morale within MDPW, the training team's role as external trainers became somewhat problematic. Their location in an office outside MDPW allowed training staff to maintain perspective on the turbulent situation, but it also isolated them from sources of information about changes. It was critically important for training staff to remain informed about changes and aware of the tenor of MDPW's organizational environment, because these factors affected programming, sometimes seriously.

To increase information flow and improve the team's ability to respond to MDPW, training staff increased their linkages to MDPW and their visibility within MDPW. They accomplished this in three ways.

First, they located their program assistant, responsible for academic programming, at MDPW 3 days a week. This immediately improved the quality and quantity of information sharing between the two organizations and increased the visibility of the training program. Employees could more readily ask questions about the program, give feedback about it,

and discuss MDPW issues. Increased information and feedback helped staff get a better sense of the impact of changes in MDPW on the program and allowed them to respond more effectively. Training staff were able to experience MDPW's culture and events firsthand. This provided a better perspective on the organization and on more effective ways of interacting with it. The change in staff location and in perception of training staff as "internal" external trainers has significantly affected staff responsiveness, increased participation in programming, and made the program a real part of MDPW.

Second, the program administrator and training coordinator increased their visibility within the department to offer support to employees. Following the organization states model, these staff made themselves available as counselors who helped by listening, facilitating problem solving, and bringing a positive perspective. Employees began to see that staff cared about them as individuals and cared about helping the department. Consequently, employees began sharing more information and discussing organizational issues they previously would not have discussed with the training staff. One manager invited staff to attend his division's meetings to learn more about MDPW's work. The increased visibility and supportive interactions helped move the training team further into the organization and helped develop MDPW's trust in the team.

Third, staff members took a more active part in MDPW's informal communication system, attempting to reduce rumors as much as possible. Because staff were in class with employees several times a week, they checked rumors heard in class and reported back to class members on what was learned.

As a result of these changes in the training team's role, training staff were no longer seen as external consultants but rather as staff who "belonged" to MDPW. This significantly increased contacts between the training staff and MDPW, which led to improved information about organizational and training issues and more relevant programming.

Modification of the Training Program

Training staff realized that the training program provided a critical means of rebuilding MDPW's morale and ability to survive as an organization. The program could, in Kotter's terms, affect all MDPW's elements and key processes. Staff also knew that training was the only reward the department could then offer. As a strategy, staff changed the focus of training and expanded employees' opportunities to participate in training activities.

New Focus for Training

Drawing largely on the organization states model, training staff focused short-run training on improvement of morale. They increased the number of courses that would give employees opportunities to strengthen their abilities to cope with changes and to accomplish basic tasks. Most important, they scheduled a series of stress management seminars for all levels of personnel and made available books on stress. They offered highly practical programs such as typing and report and letter writing to develop skills employees could use immediately. Working closely with instructors, staff tailored a supervisory course to examine issues of leadership and planning in a crisis environment and motivation under stressful conditions.

Generic training was no longer appropriate for MDPW. To assure that all courses reflected methods

of coping with the environment in a positive manner, staff discussed the new emphasis with instructors and structured courses to reflect that emphasis.

Increased Opportunity for Participation

Despite the possibility that understaffed units might not be able to send trainees and that classes might not be filled, training staff continued to offer classes as usual. However, they changed the training format from 10-week sessions on one topic to predominantly 1-day sessions that placed fewer time demands on trainees and their units.

Training had previously been offered at a few central sites. To improve the opportunities for district employees to attend training, staff began taking programs to individual districts. In some cases, training staff developed and delivered special programs to meet the needs of the more distant districts. This enhanced the perception of the program as responsive to needs.

As a result of the reevaluation and modifications of the program, employees came to class with increasing willingness. Attendance improved despite many problems in trainees' offices. There was significantly less resistance to training than there had been in the early days of the program, and the credibility of the program and staff increased. Managers began requesting specific programs for their employees.

Summary

In summary, systematic analysis of MDPW, using the Kotter and organization states models, helped training staff realign their roles and the programming for MDPW. The models clearly provided direction and control in a time of great turbulence; they facilitated effective decision making by the team. Without this guidance, the training team itself might have moved from a problem-solving state to a stage of fabric crisis. In such a state the team and the program would have been of little value to MDPW. Instead, the foundation laid during the critical changes of 1981 has strengthened the ability of the training team to help MDPW move from crisis toward restabilization.

ACTION RESEARCH APPROACH TO TRAINING

Systems models helped staff understand MDPW and their relationship to MDPW within a dynamic systems context. The models facilitated the forecasting of various intervention strategies and prescribed appropriate approaches for staff to take. But implementation of the plans and strategies suggested by the models required an operational strategy for working within MDPW. This approach had to be consistent with MDPW's and the training team's organizational states and with the training staff's style and assumptions about organizations.

Training staff predicated their operational strategy on their beliefs that an organization (a) can, with assistance, identify and solve many of its own problems; (b) has many human resources capable of facilitating change or teaching others their expertise; and (c) should "own" its education and training programming through participation in its development and delivery. Further, a participative process was critical because training staff offered expertise in training technology and organizations, and MDPW staff offered expertise in technical areas and knowledge of their own agency. The approach that

best serves these assumptions is called action research. A form of action research thus became the basis for the training team's responsiveness to MDPW, for the relevance of the training, and for some organizational change related to training.

Action research generally involves the following steps: structured information gathering about an organization's problem areas and needs, feedback of the information to groups of employees, analysis and prescription for action, action, and evaluation and feedback into new assessments of needs and issues.

Action research involves members of the organization in defining their own problems and needs and in determining what actions should be taken to resolve problems. At each step organization members may influence and modify action steps. The process helps organization members learn how to carry out information gathering, problem solving, and action step processes on their own. This helps create and maintain a healthy problem-solving organization.

Training staff use the action research approach to identify training and education needs, develop programming, help MDPW establish systems that support use of newly developed skills, and strengthen organizational problem-solving skills. Training staff's use of action research and the results they achieved are described next.

Identifying Needs and Developing Courses

To identify needs, training staff engage in a multi-stage information-gathering process. They interview MDPW managers, supervisors, foremen, and laborers about needs, then work with ad hoc advisory committees to refine needs and develop course outlines. To gain additional perspective, staff discuss training issues with their FHWA monitor.

Identification of Performance Problems

Initial discussions focus on task areas in which MDPW employees are not performing as well as they should. As the discussion continues, in committees composed of a representative group of MDPW task experts, the job tasks are examined in detail and reasons for poor performance are explored to determine what factors other than skill deficiencies may contribute to the performance problem. With input from the committee, staff define the extent of the performance problem: who is affected, what units or divisions are affected, and how. This analysis may lead to a prescription of different types of training for different levels of personnel to assure a change.

Staff always ask, "If we train people, what will prevent them from using their new skills?" Because of their organizational diagnosis work with the systems models, staff already have some ideas about what the barriers might be and how serious they might be. This analysis may show that training will only be successful if combined with changes in organizational policies, procedures, or structures. It may also suggest the need for improved communication between central office and districts. In such cases, training staff discuss the committee's findings with appropriate managers and recommend action.

Course Development

Training staff may involve advisory committee members or their FHWA monitor in course development and instruction in order to tailor courses to needs. In developing a contract negotiations course, staff

worked with an MDPW expert to define the course, create MDPW-specific handout material and simulations, and instruct the class. The FHWA monitor participated in the course, modeling the steps he wanted MDPW negotiators to follow.

Examples of the Action Research Approach

Training staff have found the action research approach extremely useful for creating successful training and education programs. The approach not only helps develop relevant programming, it also prepares the organization to support programs and reinforce use of new skills. Three examples of the use of this approach follow.

Action Research Approach to Technical Assistance

Training staff employed the action research approach in responding to a manager's request for training assistance. The manager identified a potential problem with his clerical personnel and invited training staff to diagnose the situation and deliver appropriate training.

Staff first met with clerical supervisors to elicit their views of the situation, then proposed that they meet with clerks to expand the perceptions of the problem. Subsequently, staff conducted an information-gathering session with clerks to determine what they saw as issues and concerns and what solutions they envisioned. With all this data in hand, training staff summarized responses, identified potential problem areas, and suggested both training and organizational change activities. They presented their findings and recommendations to the manager and supervisors and then to the clerks.

Training staff then developed a series of training activities to meet needs identified by the clerks and supervisors and provided assistance with organizational change tasks. The manager supported the training effort, writing to all trainees to encourage them to use what they had learned and praising them for changes he had noticed.

In this example, the action research approach involved department personnel in identifying their own problems and prescribing solutions. Training staff facilitated the gathering and sharing of information that was available in the system but that was not in the open where it could be used. Staff provided follow-up training and resources that not only improved performance skills but also improved teamwork.

Action Research Approach to Course Design and Organizational Change

The most exciting application of action research at MDPW is training staff's use of a foreman advisory committee to develop courses and stimulate organizational change in the maintenance division. Because of the committee's efforts, resistance to foremanship training has been reduced significantly, policies are being changed to support use of skills, and methods of improving communications between management and the labor force are being instituted.

Establishment of a Committee

Working with the assistant maintenance engineer, training staff established an advisory committee comprised of the engineer and various levels of foremen from different districts. Two men selected for their expertise were also union officers. The

committee's task was to help training staff define training curricula for foremen, bridge carpenters, and equipment operators.

At their first meeting, the committee said the foreman's job description had lacked definition for some time because of increasing contracting of labor functions and an unclear department mission. It was necessary to define the foremen's role before developing training. The foremen believed that other states defined maintenance workers' roles well and ran effective maintenance operations; they indicated they would like to learn how other states accomplished this and outlined what they wanted to learn.

Consequently, training staff, working with the assistant maintenance engineer, arranged meetings with the Maine Department of Transportation (DOT) and New Hampshire Department of Public Works and Highways maintenance division staffs. The foremen planned premeeting information packets that they exchanged with the other DOTs and planned the meetings themselves. In each state, MDPW advisory committee members met with their counterparts to discuss staffing, job descriptions, and maintenance operations and problems. Training staff observed the meetings and gave the foremen feedback on their meeting-management skills after each session. On returning, the group discussed what they had learned and made recommendations about MDPW foremen's roles to an MDPW personnel committee.

Development of Courses

Having redefined the foreman's role, the advisory committee met frequently with training staff to outline topics for the foremanship course, prepare materials for the class, and learn instruction skills. Other foremen were added to the committee to increase district representation and include potential instructors.

While developing course content, the committee identified inconsistencies in MDPW policy and procedures that would conflict with desired foreman performance. The assistant maintenance engineer, who was promoted to deputy chief of maintenance during this process, assured the group that he would revise policy and procedures. The process of developing the foremanship course thereby led to identification of problems, proposal of solutions, and action that resulted in organizational changes.

Creation of Change

After developing the curriculum, the committee considered how to introduce the course in a manner that would encourage support of the program. Historically, all levels of foremen had resisted training. The committee and the deputy chief knew the program would succeed only if the supervising foremen recommended it to their subordinates and supported the techniques being taught. So the committee worked with training staff to plan preview sessions for the supervisory foremen so they could experience the program and give feedback on it before it was offered to their staff.

The preview sessions, attended by the deputy chief, were critical events. In action research terms, the sessions expanded participation in the course development and acceptance process by "checking out" the proposed program with the people it would affect. The sessions stimulated discussion of maintenance problems that MDPW managers had not previously heard about and provided foremen an opportunity to talk directly with their division chief.

The dialog resulted in (a) agreement that maintenance foremen should meet with the deputy chief twice a year without their maintenance engineers, (b) request for statewide standard operating procedures that would eliminate inconsistent maintenance operations, (c) recognition that central office knew and understood district problems and was willing to make changes, and (d) support for the foremanship training.

Because the programming was being developed by an MDPW committee with the guidance of training staff, it was seen as a relevant grass-roots program. The potential for change in operations was seen as positive because the changes were suggested by MDPW employees as part of a problem-solving approach. They were not imposed from above or from the outside.

This example illustrates the power of an action research and training approach to create organizational change and acceptance of needed training programs. This approach requires more time and energy than traditional curriculum design and delivery, but its benefits are greater and longer lasting.

Action Research Approach to Education

In addition to using action research to plan training, staff have used the approach to plan educational programming.

After conducting a questionnaire survey of employees' educational needs, staff set up meetings to further assess the needs of employees interested in civil engineering technology courses. The meetings included MDPW employees, community college representatives, and training staff. Meetings were structured to inform MDPW employees about academic programming and the kind of commitment that participation in the programs required, and to help the college and training staff carefully define the diverse needs. Through group identification of issues, staff were able to propose courses of action that met needs of beginning, intermediate, and advanced students. This approach provided the maximum amount of information about programming, needs, commitment levels, and potential problems and stimulated a variety of suggestions for programming.

Summary

Training staff chose to use action research as their operational strategy for working with MDPW and implementing interventions suggested by the systems models. The use of action research in an organization recovering from a crisis state has proved particularly appropriate.

Use of the action research approach has helped rebuild morale and organizational pride. Those who participate on advisory committees learn they can take control of parts of their organizational life and contribute to progress and renewal. They are recognized for the programs and changes they create. Those who attend training programs and watch their peers instruct take pride in the expertise available in the department. Action research helps rebuild the skills and confidence of the organization and, most important, develops the organization's problem-solving capabilities. These skills can help lead the organization back to a vital state.

Further, use of action research has (a) assured that training and education programs meet real needs, (b) created organizational supports for training, and (c) stimulated organizational change in areas that systems models suggested were weak.

In addition to strengthening MDPW, the approach has prompted a very effective relationship between

training staff and MDPW. It has allowed trainers to combine their training and facilitation expertise with the technical expertise within the organization. Thus training staff and the organization are working cooperatively to help MDPW develop its capabilities and achieve its potential.

IMPLICATIONS

The systems model and operational approach described in this paper helped the Institute for Governmental Services training team provide appropriate training and education programming to MDPW while the organization was undergoing major changes. The models offered frameworks for assessing MDPW and planning how best to serve and work with the organization.

Given the complexity and instability of MDPW's environment, how training staff delivered training became as important as what they delivered. It was critical that staff stop action and reassess not only MDPW but also their own team organization and roles vis-à-vis MDPW. The constant reassessment engaged in by the training staff helped maintain their flexibility and responsiveness to MDPW's needs. To use both Kotter and organization states model terminology, the training team needed to maintain the adaptability of its own elements and to engage in problem-solving processes to continually realign itself with MDPW's changing status. This reassessment and realignment must continue as MDPW emerges from crisis and restabilizes.

As part of their responsibility to MDPW, training staff are attempting to help that organization develop and maintain adaptability and strengthen survival skills. To do this, staff employ a form of ac-

tion research that involves groups of organization members in all phases of training from needs assessment through program delivery. Using this approach, which stresses problem identification and resolution, staff are helping strengthen the organization's ability to solve problems and take control of its own future. In times of rapid change and organizational transition, this may be the most important survival skill a training unit can develop in an organization.

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Inexpensive Travel Demand Model for Small and Medium-Sized Cities

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ABSTRACT

A simplified travel demand model that uses routinely collected traffic ground counts to forecast traffic volumes on a street system is described. It is an internal volume forecasting (IVF) model based on a model first proposed by Low in 1972, and incorporates improvements suggested by Smith and McFarlane in 1978. The model is applied to the city of Spokane, Washington. Results from this application indicate that routinely collected traffic counts in a base year can be used to estimate traffic volumes in a horizon year with reasonable accuracy. By eliminating the need for a home-interview survey, the model provides an inexpensive, quick, and transparent technique for forecasting travel in small and medium-sized cities. The model is also suggested for use

in cities of less developed and developing countries because of its simplicity and low cost. The output from this model is essentially trips for all purposes. Home-based, non-home-based, and other trip categories could also be obtained with additional data.

The main objective of transportation planning is to provide the information necessary for making decisions on when and where improvements should be made in the transportation system and for controlling travel and land development patterns that are in keeping with community goals and objectives (1, pp. 8-9). One of the most important pieces of information, which is crucial for such decision making, is horizon-year traffic volumes on the major links of a city's transportation network.