2.0. Building Management Tools

2.2. Example Types of Tools

2.2.2. Program Management

2.2.2.1. GOAL-ORIENTED PLANNING

2.0. Building Management Tools

2.2. Example Types of Tools

2.2.3. Emergency Management

2.2.3.1. MANAGING CHANGE—JEAN-AUGUSTE-DOMINIQUE INGRES

2.2.3.2. NEED FOR EMERGENCY MANAGEMENT TOOLS

For their responsibility in managing uncertainty, emergency operations organizations need management tools that stand up to today's heightened scrutiny, increased openness, the resultant great expectations, and demand for accountability during emergency situations.

When an emergency strikes, will the organization be *ready* to protect life, property, and the environment? Will the appropriate response resources be available? Will the right information be available at the right time? Will the hard work of the emergency operations organization (EOO) facilitate the prompt and effective management of this emergency?

An EOO is the foundation of the emergency management structure because it orchestrates the preparedness, response, recovery, and mitigation activities of line organizations, emergency management teams (EMTs), and their own staffs before, during, and after emergency conditions. EOOs are required to ready, coordinate, and sustain sudden shifts from normal operations to emergency conditions.

EOOs face more demands from their constituencies than ever before. Coupled with increased scrutiny is the difficulty of managing sudden changes in roles, responsibilities, and resources inherent in emergencies and exacerbated in potential multiple incidents. In switching between managing routine operations and emergency conditions, EMT personnel must suddenly transform their managing skills and information and resource requirements to meet the fast-paced emergency context. The EOO must possess the skills and tools to successfully make the shift to and facilitate the management of emergency conditions.

EOOs also experience considerable pressure because an unknown *potential* emergency is a perplexity. Perplexities are extreme management pursuits characterized by ill-defined, complex, unique, and unpredictable situations with potentially severe consequences. For a fuller treatment of the term *perplexity,* please see Modules 1.4.5.2.1. and 2.2.3.5. Because perplexities involve uncertainty, they require sudden changes in the amounts, types, and means of delivery of information to support decision making. EOOs manage the amounts, types, and means of delivering information before an incident, so when the incident occurs, managers have the information they need.

The EOO provides the right information to support emergency management teams and line organizations when they participate in any of the four activities: emergency preparedness, response, recovery, and mitigation shown in Figure 2.2.3.2. The figure also shows the relative responsibilities of the EOO, line organizations, and EMT. EOO responsibility is constant and is the foundation for all four activities and thereby supports and provides continuity through all emergency management roles and responsibilities. The line organization performs those emergency activities germane to their operations utilizing the foundation developed, maintained, and coordinated by the EOO. Emergencies occur suddenly as does a lightning bolt (jagged arrows in the figure). The response role of the EMT appears in a flash. The EOO role of readying, coordinating, and sustaining line organizations and the EMT in its response role is subject, before and after-the-fact, to intense external and internal scrutiny. Such scrutiny is important to developing the ability of the EOO to deliver

the right information and tools at the right time to the EMT for decision making in preparedness, response, recovery, and mitigation. Balancing external scrutiny with internal scrutiny, as shown in Figure 2.2.3.2., helps managers be responsive to external scrutiny by anticipating (foresight) rather than looking back (hindsight). Because of public scrutiny and sudden shifts into emergency conditions, EOOs need the proper set of tools and guides, so when an emergency happens, their constituencies are confident the best decisions are made based on the best information.

Emergency management tools can be defined by starting with successful management tools, proven in managing routine operations. We can generate new sets of tools based on the principles underlying the successful tools but constrained to suit emergency management responsibilities. A sufficient set of emergency management tools and guides doesn't exist.

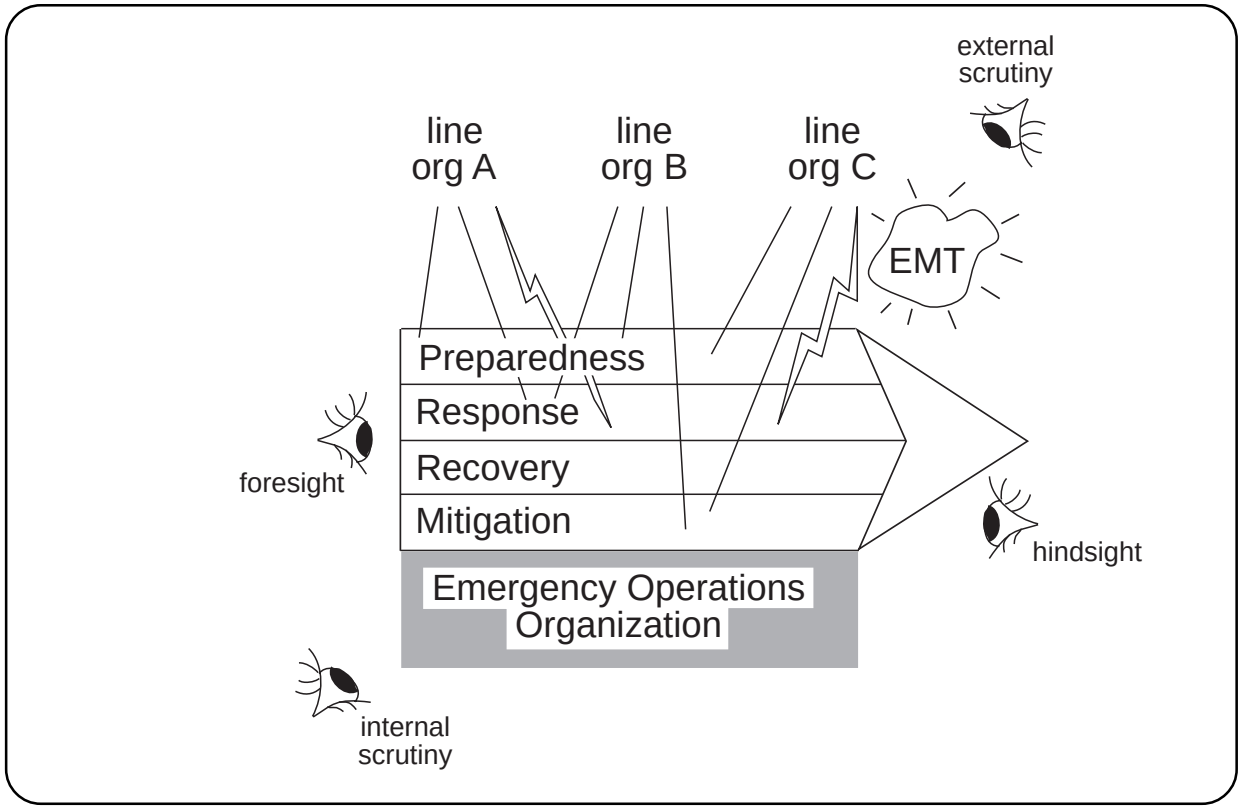

Figure 2.2.3.2. *In the face of scrutiny from all directions, the EOO needs the means for providing information and support as it sustains and coordinates the emergency preparedness, response, recovery, and mitigation activities of all participants.*

2.2.3.3. A New Approach to Tools Aimed at Perplexities

So the EOO can respond to information needs for sudden shifts from routine operations to emergency conditions, we need a new approach to understanding, developing, and using synergistic tools working through effective guides aimed at perplexities. The tools and guides of this new approach must help EOOs consistently get, store, retrieve, see, and communicate information selectively aimed at the appropriate emergency management activity.

We need a new approach to tools aimed at perplexities so we can assist EOOs in their efforts to ready, coordinate, and sustain line organizations and EMTs as, together, they manage emergencies. For the new approach to succeed, it must help EOOs cope better with perplexities and their associated uncertainty and unique information requirements. What is the nature of an emergency from a decision-making and information-requirement perspective? What principles guide the selection and use of the right information? Can we figure out management tools for converting raw data into useful information as well-suited to perplexities as we have for our more routine pursuits?

Throughout the four emergency management activities (preparedness, response, recovery, and mitigation), EOOs have relative continuity in roles, responsibilities, and resource requirements compared to line organizations and EMTs. Line organizations switch from routine operations to any of the emergency management activities when called upon. And EMTs make the most dramatic switch. The switch involves different information and different tools for recording, verifying, storing, arranging, and accessing data to make information by comparing data to different reference points.

By selecting and applying the appropriate tools working together, EOOs can give EMT personnel acting in emergency management roles the information they need when they need it. Management tools and the guides through which they work must function within a synergistic integrated package if they are to work effectively in perplexities. Tools designed for use in routine operations and those tools currently used in emergency management won't necessarily work for emergency conditions *unless we understand the underlying principles* behind the tools' use, and adapt the tools for use in perplexities.

What's more, emergencies require a lot more information than non-emergencies. The closer the ratio (information EMT personnel need/ information they have) is to one, the more effectively they can confront perplexities.

The classical management principle (Tushman & Nadler, "Information Processing as an Integrating Concept in Organizational Design," *Academy of Management Review*, July 1978, pp. 613-624.) for information requirements for organizations facing different degrees of uncertainty is illustrated in Figure 2.2.3.3. and is adapted to highlight the situation encountered by EOOs. Classically, good management in certain conditions means relatively low information requirements and in uncertain conditions means relatively high information requirements. As shown in Figure 2.2.3.3., the problem with an emergency is that the change in information requirements is a large and abrupt step function. The sudden change in information requirements includes the

amount of information; timeliness, accuracy, and relevance characteristics of the information; and the resources (equipment and trained people) for delivering the information. The extreme time factor means it's crucial to be ready with the necessary information.

We can help EOOs gain better control of perplexities by helping them to know: 1) what tools work best in perplexities; 2) what guides govern the most effective use of those tools; and 3) how to get, store, retrieve, portray, and communicate the right information. When EOOs manage effectively day-to-day, if an emergency hits, the right tools and information are ready.[1]

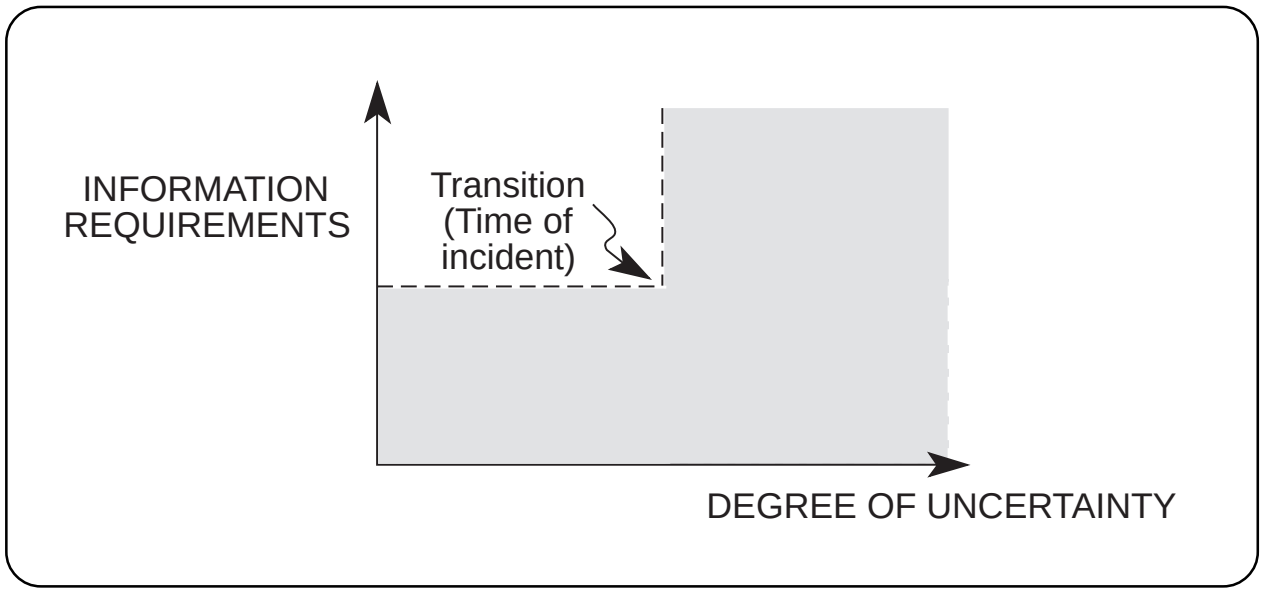

Figure 2.2.3.3. *When uncertainty increases dramatically, so do information requirements for effective management. EOOs need management tools to provide information for EMTs during situations of high uncertainty and sudden shifts to uncertainty.*

[1] The emergency manager is like a stage director who must orchestrate preparedness, response, recovery, and mitigation. Stage directors set the stage, the actors, and support people by producing, coordinating, and directing all props, cues, script, lighting, sound, and rehearsals for a successful production. When the director pulls all the tools and arrangements together with the ability and talents of the actors, their audience and critics respond favorably. We need to know what tools the emergency operations manager needs, how the tools should be used, and why the tools do what they're supposed to do so the audience (the public) and critics (surrogates of the public—the media and legislative bodies) provide superlative reviews. The difference is that the emergency operations manager doesn't know what the play is, where it's being put on, who the actors are, or when curtain time is.

2.2.3.4. THE FOUR ACTIVITIES OF EMERGENCY MANAGEMENT

To effectively address the important issues and information within the context of urgent conditions, EOOs must direct and channel information using tools well-suited to the unique characteristics of emergency activities to assist line organizations and EMTs in their managing of perplexities in real-world settings.

For EOOs, emergency management is more than response. Over all four activities of emergency management, EOOs need to address important issues to help deal with urgent issues. EOOs want to help managers in emergency conditions work smart, not work frenetically. They particularly need tools so they can attend to what's important before it becomes urgent.

In terms of addressing the needs of EOOs, emergency management is much like dealing with a leaky roof. When you have a leaky roof and it's sunny, nobody worries about fixing it. That's because, when it's sunny, people often aren't concerned about preparing for a rainy day. But when the rain comes, it's too late. So it is in emergencies. During normal, non-emergency operations the line organization is concerned with normal activities, but the EOO is concerned with improving the database and other emergency management needs. When an emergency strikes, suddenly circumstances require extensive information. In an emergency, without good programs and adequate planning (foresight), good data may be unavailable, ineffectively integrated, or inadequately portrayed. Although EOOs work very hard, new leaks are constantly developing. An integrated set of emergency management tools will help EOOs address their leaky roof problem.

Figure 2.2.3.4. shows the cyclic and recursive nature of the four activities for emergency preparedness, response, recovery, and mitigation. Figure 2.2.3.4. also shows the integrated set of synergistic tools as being central to feeding the information, decisions, and understanding from one activity into any of the other activities. EOOs want to plan for the important to help mitigate the urgent.

To implement emergency management tools, we must understand: 1) what roles, responsibilities, and resources EOOs need for the four activities of emergency management to ready, coordinate, and sustain sudden shifts from normal operations, including potential multiple incidents; 2) the reason why EOOs require the information they do to meet their responsibilities; 3) the principles behind the selection of an integrated set of tools to provide that information; and 4) why those tools work, by applying the principles of decision making and information support and designing the tools for emergency preparedness, response, recovery, and mitigation. Emergency management tools must:

1) recognize the unique qualities of perplexity management;

2) obtain, integrate, and portray necessary information through an integrated package of tools to support decision making by EOOs facing sudden change from normal operations to emergency conditions;

3) facilitate the coordination and integration of efforts among multiple layers of

emergency responsibility—incident scene, line responsibility, and senior management; and

4) provide a support system to handle the compound effects of multiple emergencies within hierarchical organizations.

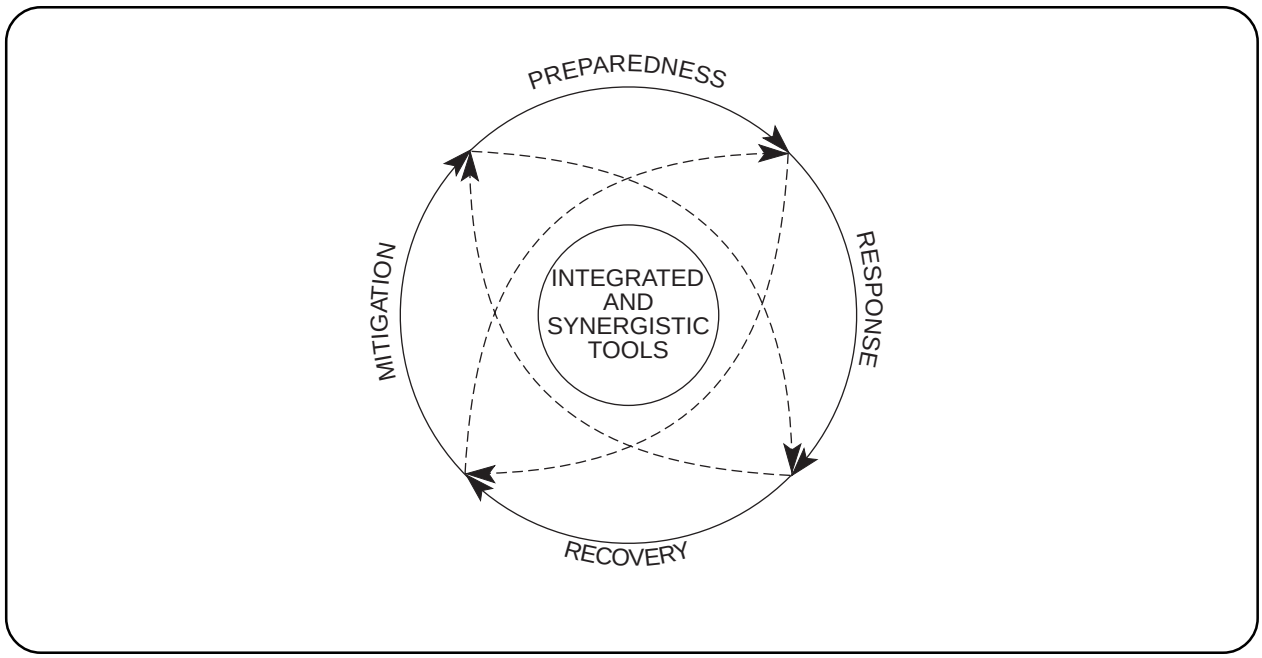

Figure 2.2.3.4. *We need to develop tools well-suited to use in the four activities of emergency management.*

2.2.3.5. CONCEPT OF PERPLEXITY MANAGEMENT

EOOs need to address perplexity management to achieve success; that is, they must prepare information sources and delivery systems, the decision environment and the decision makers, and use management tools to achieve high information richness to assist the decision makers in reducing uncertainty by driving ill-defined or emergency conditions toward well-defined or normal operating conditions.

What are perplexities? Perplexities are the most uncertain of all management pursuits. Uncertainty is the ratio of the information we need to the information we have (See Module 1.4.5.2.1.). Emergency preparedness is the classical example of a perplexity. The EOO doesn't know until the event occurs what the emergency conditions might be or what outcome the unknown event might lead to. If problem-solving is knowing: 1) where we are (WWA), 2) where we want to be (WWWTB), and 3) how to get there (HTGT), then the emergency preparedness problem is certainly a perplexity because we don't know WWA, WWWTB, and HTGT. To solve perplexities, we not only need information about where we are going and how to get there, we also need information about where we are at any point in time. We need detective information as well as corrective information.

When the emergency incident occurs we know more: We know WWA. Then we have a management pursuit called a problem, which is more certain than a perplexity. The EOO then has the first information on the type, severity, and scope of the emergency and can bring the tools and information systems to bear as the perplexity unravels. Managing perplexities and problems is what EOOs are all about. Figure 2.2.3.5. shows perplexities and problems as high on an uncertainty spectrum, while routine operations, like R&D programs, projects, and processes, tend to be lower in uncertainty. To achieve success, EOOs must manage information so the amount of quality information needed by decision makers equals the amount of information available. Inequality of information needs and information availability requires EOOs to adjust information needs or the amount of information possessed. EOOs need uniquely designed management tools, high in information richness, to help reduce uncertainty. Richness is defined as the potential information-carrying capacity of data (See Module 1.4.4.2.).

Figure 2.2.3.5. illustrates how we manage uncertainty. In managing emergency preparedness (perplexities) we assume a number of different types of incidents (problems) and plan, gather resources, and exercise for a possible chemical release, terrorist attack, computer crime, radiological release, or other type of incident. We make a perplexity into a series of possible problems. In emergency response (problems), we work to achieve alternate possible qualitative outcomes to a given incident. For the example problem of a chemical release, qualitative outcomes could be: stop the chemical release, contain the chemical release, evacuate away from the chemical release, or clean up the chemical release. We make a problem into the next, more certain, pursuit in Figure 2.2.3.5.

EOOs must address the need for rich information (e.g., complex, on-the-scene, oral communication) and the fact that scrutiny and accountability require simple, structured and emotionless information interpretation (e.g., written status boards and press releases).

So what tools can EOOs provide to support the four characteristic activities in emergency management? How about the management tools we use every day in routine operations? We use Management by Objectives (MBOs) in managing production and Critical Path Method (CPM) in managing projects. (Production, or processes, and projects are the two most certain management pursuits in Figure 2.2.3.5.) MBOs and CPM require knowing what the end of the management pursuit is (WWWTB). So do two other tools we use every day: life-cycle costing and resource loading. In processes and projects we know the end (WWWTB). But perplexities and problems aren't like that. In short, the tools we learn to use for success in the processes and projects of our routine operations will not necessarily work for emergency preparedness, response, recovery, and mitigation. (They will work, however, for a project like building an Emergency Operations Center.) Most tools for process and project management were neither designed nor tested against the unique characteristics of perplexity management.

Two traditional approaches for finding tools that will work for emergency preparedness, response, recovery, and mitigation are: 1) to try tools we use in routine operations (with the potential for failure just discussed) and 2) to develop any tool we perceive to be well-qualified for emergency management. The new approach is to address emergency preparedness, response, recovery, and mitigation by developing a comprehensive, integrated set of synergistic tools, all of which incorporate the information requirements and unique characteristics of perplexity management.

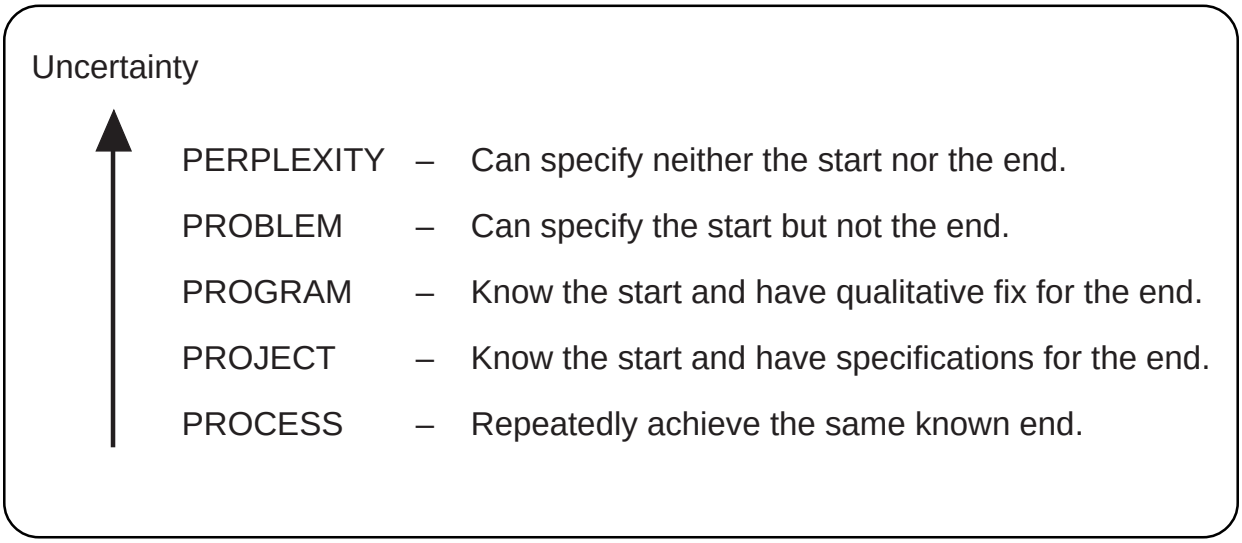

Figure 2.2.3.5. *EOOs address the uncertain end of the spectrum of management pursuits, whereas the tools we know best are proven in our routine operations at the lower end of the spectrum.*

2.2.3.6. A SUPPORT SYSTEM FOR MANAGING PERPLEXITIES

Understanding what constraints are unique to perplexity management and systematically applying these constraints to the fundamental principles underlying management tools proven in process and project management is the first step in understanding how to build an Integrated Perplexity Management System.

We manage emergency preparedness, response, recovery, and mitigation by using information media capable of providing high information richness to reduce equivocality (differing interpretations). That is, we want to work down the spectrum to reduce the equivocality in what we manage, and work up the spectrum to increase the capacity of our management tools in providing rich information in uncertain conditions. EOOs want tools for managing uncertain conditions that are at least as effective as those they use for normal operations.

Management tools convert data to information. Decision makers convert information to actions. We often suffer from a data-rich, information-poor situation because we don't understand what information we need for the decisions we make. We end up with not enough good information from credible primary sources.

We can, however, look at tools successful in routine operations, the processes and projects at the lower end of the uncertainty spectrum in Figure 2.2.3.6. and identify five types of management tools effective in converting data to information: 1) relationships and structures; 2) methods; 3) guides and rules; 4) precedents; and 5) the data-to-information chain (Module 1.4.2.6.3.). These management tool types are shown across the top of Figure 2.2.3.6. Examples of the types (together with emergency response examples) are: 1) organizational structure (EMT organization), 2) hazard analysis (e.g., plume model), 3) plans or procedures, 4) social system or culture, and 5) management information system.

The effective tools in *certain* management pursuits (e.g., projects) are those that have been heavily constrained to meet the specific needs of the decision maker. But, the more a management tool is constrained to do a job well in a specific situation, the less useful that tool will be when used for a different situation.

Let's consider a single management tool like a calendar. To make the calendar work well, Manager A heavily constrains his or her calendar to be pocket-sized, to have a page for each month, and to show weekly staff meetings, travel dates, important milestones, and much more. However, this calendar won't work very well for Manager B, who wants a wall calendar showing a year at a glance. We need to remove the constraints of Manager A, generate the general principles of a calendar, and apply the constraints of Manager B.

Starting with management tools that are successful for projects or processes is smart, because managers have invested a large amount of time and effort in developing and understanding these tools. But, similar to the calendar example, we believe tools heavily constrained to work well for projects won't necessarily work well for perplexities. We have to remove the project constraints, identify the general principles, and apply the constraints specific to perplexities.

For the Critical Path Method example discussed in Module 2.2.3.5., the constraint for using CPM in projects is that projects have a defined and known end. By removing the constraint, we discover the basic management principle of focusing management attention on bottlenecks. Now we have to figure out how to constrain managing bottlenecks for perplexities, because emergency managers have bottlenecks too. In effect, we're working from using CPM as a structure tool for projects, up the uncertainty spectrum to perplexities, as shown in Figure 2.2.3.6.

The way to develop an Integrated Perplexity Management System (IPMS) is to start with proven management tools constrained for processes and projects, carefully investigate and strip away the constraints to reveal the basic management principle the tool was conceived to support, and then develop new constraints based on our research into perplexity management. The result will be a new tool reflecting the basic principle constrained to perplexity management.

The key to working tools up the spectrum in Figure 2.2.3.6. is that we can consider a comprehensive synergistic set of tools through the complementary management principles the package represents, and constrain this set to perplexities; thus we will have an IPMS.

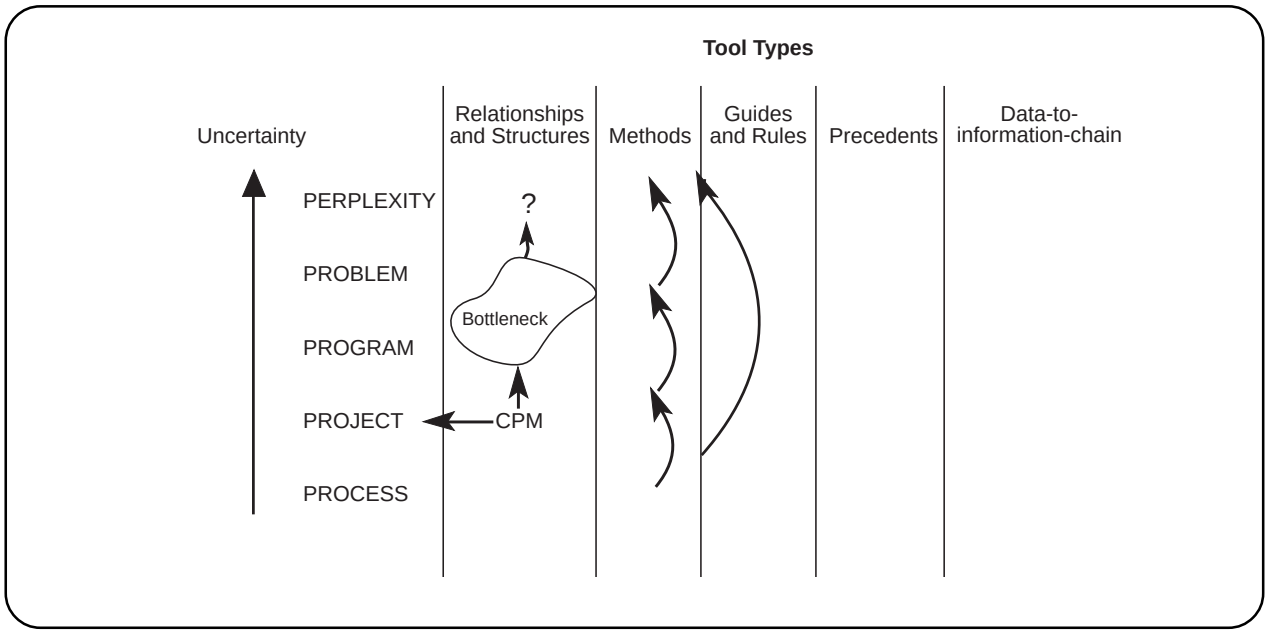

Figure 2.2.3.6. *The IPMS will include an integrated set of tools covering the five tool types and investigated by identifying and using tools we have in normal operations, detecting the basic management principles upon which they are based, and remodeling the perplexity management tool based on the principle and constrained to perplexities.*

2.2.3.7. THE STRUCTURE BEHIND THE IPMS

Tools that make up the IPMS, no matter how effective or efficient, are only as valuable as their ability to reduce the amount of time programmable decisions compete for an emergency response manager's attention.

Behind the IPMS is the realization that for the EMT to be most effective in times of emergency, EOOs must be effective both in times of calm and in times of emergency. EOOs work in process, project, and program pursuits, as well as in perplexity and problem pursuits. The information needed for managing pursuits at one end of the spectrum is different from information needed at the other. When managing at the *certain* end of the spectrum, decisions are called programmable (Herbert A. Simon, "The Executive as Decision Maker," *The New Science of Management Decision*, Harper and Brothers, 1960, pp. 1-8.) and are best made on clear, structured, logical, and verified information. At the uncertain end of the spectrum, non-programmable decisions (Simon, 1960) are made based on experience, judgment, and intuition. The information supporting these bases is ambiguous, changing, and incomplete. EOOs must manage information for both programmable and non-programmable decisions in all activities to affect the mix of programmable and non-programmable decisions during response.

The difficulty of managing the mix of programmable and non-programmable decisions in emergency preparedness, response, recovery, and mitigation activities is most acute during response because of the relative urgency of tasks. By managing the mix during other activities and linking the programmable decisions and information through the activities, EOOs manage the mix in response.

To support these differences in decision making and different information requirements during response, the IPMS must have a two-pronged approach: 1) make the clear, structured, logical, and verified information as crisp, focused, and accessible as possible, 2) make best use of the increased time for non-programmable decisions by improving and supporting the access, storage, retrieval, integration, and portrayal of information for decisions that count the most and are scrutinized so closely.

Figure 2.2.3.7. illustrates the objective of the IPMS. Because of the high uncertainty and importance of external information during the response activity, EMT personnel *need to spend* most of their time concentrating on the non-programmable decisions (part (a) of Figure 2.2.3.7.) and to have the right information to support non-programmable decisions. But, often EMT personnel don't have enough time. Because of ineffective and inefficient information concepts and tools supporting programmable decisions, EMT personnel often spend too much time on programmable decisions (as shown in part (b) of Figure 2.2.3.7.). One crucial problem is that the size of the pies in parts (a), (b), and (c) of Figure 2.2.3.7 is fixed. We aren't going to generate more time for EMT personnel, we can only help them with the time they have. Part (c) of Figure 2.2.3.7. shows if we can reduce the time demanded by programmable decisions even a small amount, the increase in time available for crucial non-programmable decisions can be increased several-fold.

In developing emergency management tools, we need to know how we can slice the pie better and how we can make best use of the pie we have. We must learn the environments and

support for programmable decisions before, during, and after an emergency condition. We need to find and address the processes and projects in emergency management, especially in mitigation and recovery, so EMT personnel can concentrate on the problems in emergency management.

Barnard (1938) and later Simon (1987) found that in decision-demanding situations (uncertain end of spectrum) we use intuitive and judgmental responses for: 1) bringing the right decision makers together in the right environment supported by the best available information and 2) using planning and information tools before, during, and after the emergency condition to reduce the distractions and equivocality posed by the myriad small-but-necessary issues on the decision maker's attention. In short, EMT personnel must sort out the urgent from the important.

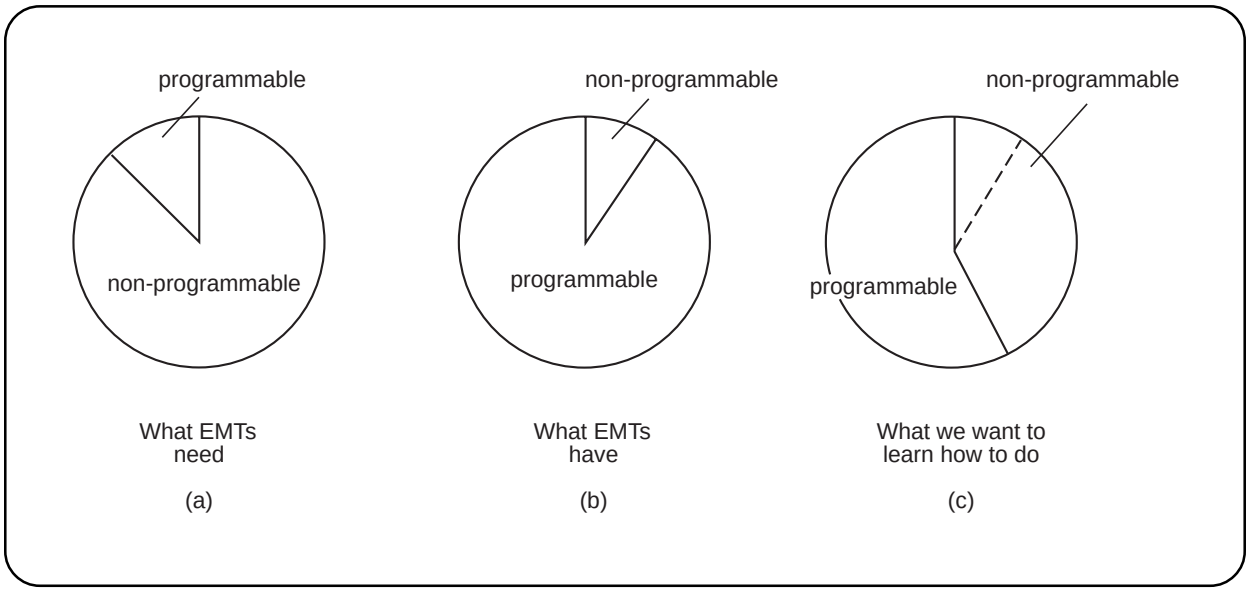

Figure 2.2.3.7. *During emergency response, EMTs need as much time as possible for dealing with non-programmable decisions, but they have so many urgent programmable decisions the important non-programmable decisions get squeezed out of the time available. We want to learn how to increase time for non-programmable decisions showing the huge leverage of good tools for programmable decisions.*

2.2.3.8. THE EOO'S ROLE AS INTEGRATOR

The role of the integrator is one of the most difficult, important, and ill-defined roles in perplexity management because of the variety of activities and the diversity of information needing coordination at many levels of the organizational complex.

EOOs provide continuity throughout the four emergency management activities of preparedness, response, recovery, and mitigation. The EOO is the one organization involved in all emergency activities and functions and in all types of incidents. It's responsible for maintaining continuity from one activity to another when needed. The EOO also ensures that lessons learned from one type of emergency are evaluated and, where appropriate, are incorporated into the management tools for entirely different types of emergencies. In short, the EOO facilitates the management of emergencies.

The most demanding part of the EOO's responsibility is to balance the leaky roof problem mentioned in Module 2.2.3.4. That is, the EOO enters into a maintenance role when the management tools are in place. This role instantly changes when an incident occurs from that of routine maintenance and operations to full organizational and resource support. Maintaining the balance between the maintenance and development role and the full-on role required by an incident highlights the EOOs role as integrator.

We've shown the emergency management activities to be interdependent (Figure 2.2.3.4.). The EOO has the ultimate responsibility for integrating the interdependent activities while meeting the sharply changing information requirements of line organizations and EMTs. As indicated in Module 2.2.3.3., the emergency manager is like a stage director who sets the stage, the actors, and support people by producing, coordinating, and directing all props, cues, script, lighting, sound, and rehearsals for a successful production.

The EOO needs much more than management tools aimed at a specific need in one activity or one incident type; it needs an integrated package of tools able to carry over from one activity or incident to another and to selectively fit whatever situation arises. This selectivity, synergy, and focus demands a comprehensively thought-out, tested, and generalized set of management tools.

EOOs have two information tasks that, during emergency response, compete for the same time and resources. One information task is to reduce equivocality so the organization shares a common view of events and alternatives. We call this task external interpretation (Weick, 1979). The other task is to process enough information to coordinate the organization's activities and manage performance. We call this task internal coordination (Galbraith, 1973). EOOs in the role of integrator provide media high in information richness to reduce equivocality and large amounts of information to handle interdependence in the organization. Effective integration and portrayal of information facilitates both external interpretation and internal coordination.

Multiple emergencies bring a special problem in that we must be able to balance separating rapidly-changing information about more than one event to partition and focus resources with combining the information to reduce redundancy and make most effective use of the resources we have—including the time and

energy of the EMT.

The integrator role underscores the importance of getting, storing, and portraying just the right information for a given situation in any emergency management activity and any incident. EOOs must maintain data integrity throughout an organizationally and geographically disparate group of managers and to reduce conflicting information, decisions, and actions.

Figure 2.2.3.8. shows the inter-relationship of all four emergency management activities. In Figure 2.2.3.8. the EOO is responsible for increasing the time available to EMTs for non-programmable decisions in emergency management activities. The EOO does this by effectively integrating and portraying information from tools. Thus, the EOO supports EMTs well despite the increased demands upon it (e.g., requirements for more openness, and strict compliance).

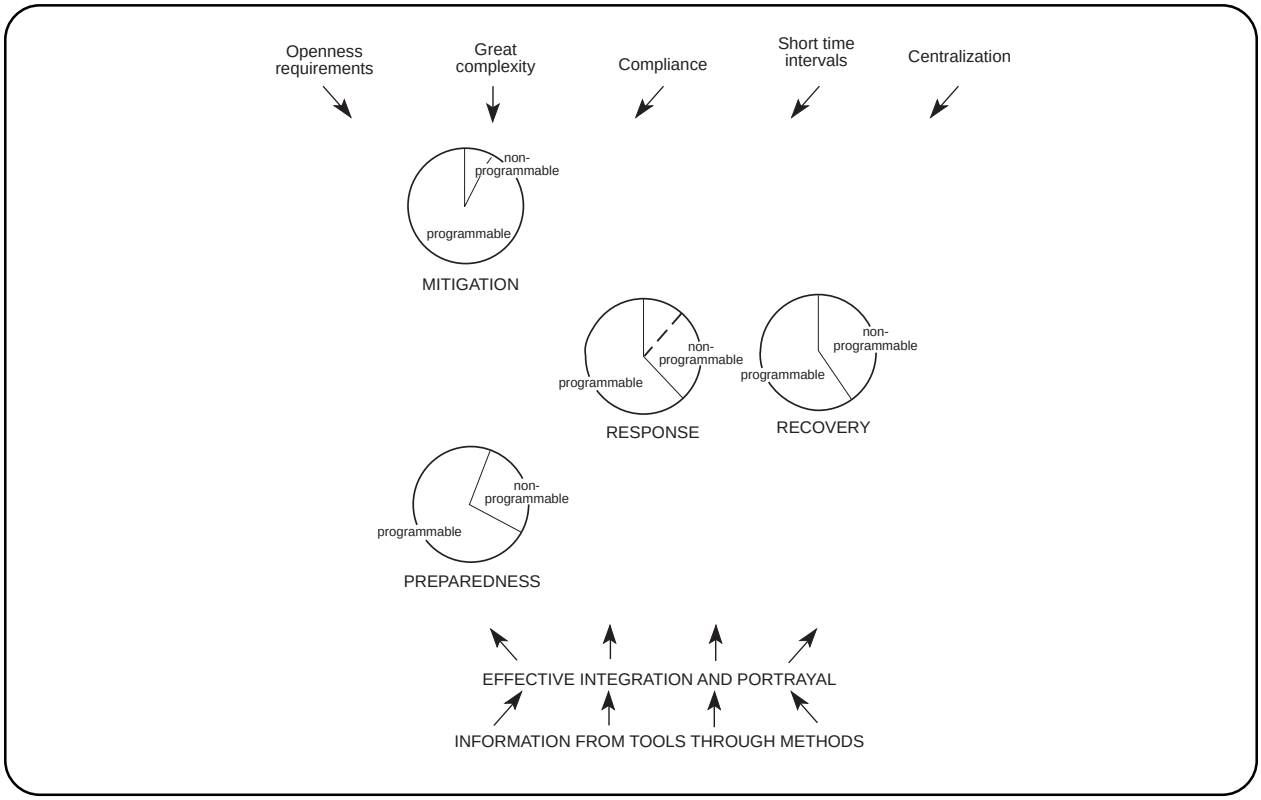

Figure 2.2.3.8. *By making best use of time for programmable decisions during all four emergency management activities, EOOs can make significant improvements in the time EMTs have available.*

2.2.3.9. CRISES AMIDST PROJECT MANAGEMENT

When dealing with crises related to a project, the project manager must have available and be able to use emergency management tools, which are somewhat different from the project management tools he or she is familiar with.

This module is adapted from Kurstedt, H. A., Jr., G. R. Patzak, L. A. Mallak, and E. M. Howard, "Crises Amidst Project Management: Strategies for Managing Better," *Proceedings of the 11th INTERNET World Congress on Project Management*, June 1992, Vol. 2, pp. 35-45.

Project managers can't always foresee every contingency when planning and managing their projects. Many spurious events affecting project milestones and resource allocations can surface once the project is underway. Experienced project managers find crises, miscommunications, mistakes, oversights, and disasters must be managed as part of successful project management. Project managers need effective tools for managing crises. These are tools project managers may not use everyday, yet they need these tools to serve them in time of an emergency.

The scope of application for emergency management tools will vary based on the size of the project. The tools can be quite elaborate, such as volumes for a risk analysis or reserved space for an Emergency Operations Center (EOC) with many dedicated phone lines. The tools can also be quite simple, such as a 1-2 page list of risks in priority order or a designated office or conference room (to function as a mini-EOC) with the ability to bring in portable phones. All the tools should be used, even if just in simple form. In a small project, using one hour of a staff meeting to assign roles in the event of a crisis may suffice for more elaborate means (i.e., formal EOC) in a larger project. The elaborateness of tools should be balanced with the cost and time required for preparation.

Projects have characteristics that make the design and preparation of elaborate tools difficult. First, many projects lack the permanence of a large plant, mine, or government installation. Second, emergencies in smaller projects tend to be more constrained to the site, while larger projects must deal with emergencies of greater scope and impact, such as chemical and radiological releases. Third, in a plant, a large number of people are affected by an emergency—especially the public as opposed to the workers. When the public or a large number of workers are involved, the organization's confidence in safe operations has a heavy influence, and this begets elaborateness. A simple tool can afford us most of the protection we need (for example, 70% of maximum), while a more elaborate tool will buy us more confidence and protection (perhaps up to 99% of maximum). The more elaborate tool is worth the investment when confidence is at stake.

I've chosen five types of tools used primarily in emergency management to help project managers manage their crises better. I'll describe and show how to apply: 1) risk analysis and vulnerability assessment, 2) logic charts, 3) tabletop exercises, 4) notification, and 5) crisis organization and communication.

Risk Analysis and Vulnerability Assessment
The primary tool for mitigation is risk analysis. Risk analysis helps us find out: 1) what can go wrong, 2) what's most probable, and 3) what has the greatest impact. The combination of an event's probability of occurrence

and severity of consequences (e.g., catastrophic failure) determines priorities. Incident analysis can also help us understand the lessons learned in an actual crisis and develop plans to mitigate the effects of similar incidents in the future.

One key strategy for managing better is to properly prepare for crises in projects and take steps to reduce the occurrences of crises. Engineering analyses support this process of risk analysis and make up the quantitative portion of mitigation. Cause-and-effect analyses make up the qualitative portion of mitigation and help us assess the systematic effects both forward and backward.

In emergency management, we use risk analysis to find out the risks beforehand. My use of risk analysis should be differentiated from a probabilistic risk analysis. Establishing the consequences of accidents or incidents by deterministic or risk analysis provides effective tools in emergency management. In project management, we concentrate on planning and sequencing activities to maximize our efficiencies and effectively schedule resources.

Project managers need to sit down and ask "What can go wrong with my project?" Once identified, the project manager has a list of risks associated with a particular project—the output of a risk analysis. Then they should ask, "Which of these risks are most likely to happen?" and "Which of these will have the greatest impact?" "On what or whom?" This last question implies the vulnerability of the organization to the identified risks. Project managers should develop plans which use the data from a risk analysis to prepare them and their organizations for the broadest range of emergencies. Risk analyses support planning by helping project managers pick the most probable and most severe events combined with a vulnerability assessment to see who or what is vulnerable and what will be affected. Therefore, when the crisis happens, the project manager has thought about the crisis and what can be affected. Plans incorporating this thinking help the project manager be ready when the crisis occurs and do what is necessary to fix it. If a manager is responsible for a project, he or she should require someone to conduct a risk analysis. The risk analysis improves early recognition of warning signs; the vulnerability assessment helps identify whom to notify and how to start support to them early.

Logic Charts

Logic charts employ project flow logic to show the project flow with all dependencies in an extremely flexible, time-scale independent diagram. Logic charts are a form of expert system because they embody the decision making knowledge of the expert in a system that can be followed procedurally. Project flow logic is the basis for any personal computer-assisted project management tool. Project managers are skilled at charting. But, in times of crisis, the charts used are different.

When a crisis occurs, people need procedures to follow. Logic charts form the basis for writing these procedures. In project management, the most commonly used charts are Gantt charts for looking at activities against time and networks for looking at precedence. Emergency logic charts depend heavily on logic because of branching due to chained contingencies (e.g., "if event X and event Y happened, then event Z is likely").

Logic charts force project managers to think through the critical decisions necessary in a crisis. Project managers won't have time to go through the logic chart when the actual emergency occurs—we're counting on the project manager learning from the preparation and thinking required to construct a logic chart and feeding this into or reinforcing it through a tabletop exercise (described later). When the crisis occurs, the project manager isn't think-

ing as clearly as usual, and the more that's been done before the crisis occurs, the better action the project manager can take.

Tabletop Exercises

Tabletops and other exercises use the information from the risk analysis in the mitigation phase to simulate the decision making and action taking occurring in an actual crisis. A tabletop is where we bring a group of people together and they act out the roles for a given scenario. These same techniques can help project managers prepare for possible crises that may occur in their projects.

The events or crises occurring to project managers won't be the things we're tracking. It's what we don't track that will go wrong. The need for tracking illustrates the use of a structured management process to catch the small problems through a thorough, systematic, and frequent review of relevant indicators (Kurstedt, Mallak, & Pacifici, 1992).

Tabletops are generally used in the beginning and focus on managerial information flows—who we talk to, what we do, who needs what information, etc. Issues surface in tabletops. Tabletops are a training device used to elicit understanding by carefully guiding the participants through a simulated emergency requiring a response. Although tabletops are typically less expensive to conduct than drills or field exercises, they cannot substitute for the simulation of actual emergency events available through drills and exercises.

I recommend conducting tabletop exercises every quarter to keep the emergency plans, procedures, and necessary thinking fresh in project managers' minds. Thinking through the decisions beforehand in an evaluative session such as a tabletop pays off when the real crisis occurs.

Tabletop exercises force managers to think through the decisions made during a crisis in advance, thereby reducing the need for decision making during the crisis and reducing the time needed to make those decisions. "A tabletop is accomplished in controlled phases to allow discrete, individual answers, which focuses group attention on each point and thereby promotes a common understanding of roles and responsibilities and the entire response sequence by all participants" (Walker & Middleman, 1988). The tabletop exercise is a versatile tool that can be applied to all phases of project management. The overarching benefit of tabletops is they require response system elements to pay attention both during development and as the system evolves (Walker & Middleman, 1988).

Notification

Emergency managers often have elaborate plans for notification in the event of an emergency. They've thought out and provided for consensus decisions on who to notify and in what order. Project managers, once they have completed a risk analysis and identified the types of crises that may occur, should convene a group of representatives from the affected parties (e.g., neighborhood, city council, media, police, fire, medical, rescue squad) to come to a consensus on who should be notified and in what order they should be notified. The political consequences of calling in the wrong sequence can be severe and each party should know and agree on its standing in the notification.

Crisis Organization and Communication

Crisis organization and communication concerns internal communication about the crisis while the crisis is occurring. Communications to and from the field must be reliable and quick. The technologies chosen for communication must be robust to crisis conditions and must have enough range to cover the distance between the emergency operations office and the furthest point in the field from which we'd

expect to receive communications.

An emergency operations center (EOC) coordinates and organizes communications and information to and from the field. Each person has a telephone, often with direct access to key response units. For example, the medical person may have a direct line to the hospital and the technical person's telephone may be linked to the laboratory.

A single status board gives everybody the same information at the same time at the same place. This reduces equivocality and improves quality of response. The EOC houses backup information, such as slides of the facility. The EOC gives managers rapid access to many different types of information, based on the expert models, to support real-time decision making throughout the course of a complex project.

When the crisis occurs, those who respond must know their roles and responsibilities and learn where to go to exercise them. The responsible people are pre-identified as an emergency management team (EMT) and they gather in the EOC to respond in ways they've learned and exercised before.

An effective crisis communication system design will take into account: 1) who must talk to whom, 2) how they should communicate, 3) what the requirements are for speed of communication, 4) how potential crises might interfere, 5) the distances we want covered by such a system, and 6) what to do in the event of system failure (e.g., backup systems, battery power). Consideration of these issues beforehand will increase the likelihood of communication needs being met during the crisis.

A crisis communication system is only as strong as its weakest link. If part of the communication system involves hand-carried messages, then electronic sophistication will only help us marginally. We should plan ahead to ensure the communication system meets our needs. We should test the communication system frequently to ensure it works properly.

A related type of communication, risk communication with the public, plays a significant role in managing the risks and perceived risks associated with a project. Effective risk communication to the public is critical. The public must feel they have some influence over managing or controlling the risk conditions. The public must have the feeling that they've supplied input considered by project managers in their risk analyses. The public must be invited and empowered to participate in decisions that affect them. During a crisis, the project manager must put good information in the public's hands immediately (a public information task). For large projects, the project manager or spokesperson should have a place (not the EOC) to meet with the media and other public stakeholders.

2.2.3.10. STRATEGIES FOR PROJECT MANAGERS TO MANAGE CRISES BETTER

To manage crises better, the project manager needs to adapt emergency management tools and practices for his or her use and fit those tools and practices to the characteristics of his or her project.

This module is adapted from Kurstedt, H. A., Jr., G. R. Patzak, L. A. Mallak, and E. M. Howard, "Crises Amidst Project Management: Strategies for Managing Better," *Proceedings of the 11th INTERNET World Congress on Project Management*, June 1992, Vol. 2, pp. 35-45.

While I don't have a closed set of comprehensive strategies to offer other project managers to manage crises better, I do have several recommendations I can offer based on my experience in emergency management. Considering the uncertainty involved in crisis management, I would be wary of any closed set of strategies. Crisis management, by definition, is perplexing, constantly changing, full of uncertainties, and challenging to any manager, especially the project manager. There is no simple solution to the complex problems posed by crises. Here are my recommendations.

1. Even for small projects, assign the job of developing at least a two-page risk analysis and vulnerability assessment before the project begins.

2. Assign somebody the job of producing a notification sequence.

3. Use logic charts to design procedures that won't go awry during a crisis.

4. Use tabletop exercises because few people will look at a logic chart or even a procedure when a crisis occurs. Project managers will depend on what they've practiced, and this underscores the need and value of tabletops.

5. Decide on a gathering place for decision makers to congregate in the event of a crisis. Backup gathering places should be arranged in case the primary gathering place is involved in the crisis. Gathering sites should have information and communication systems ready for immediate use.

6. Establish authority for crisis management before the crisis. The project manager isn't always the best emergency manager, so choose a person who has greatest knowledge of the operational issues associated with the crisis.

7. Establish an emergency operations center (EOC) and an emergency management team (EMT). The EOC should coordinate the communications to and from the field and provide information on key indicators of the crisis. The EMT mobilizes at the crisis onset to provide specialized personnel and resources for effective response and to minimize the consequences of the crisis.

8. Follow the steps used by emergency managers to progress from risk analysis to emergency management: risk analysis, problem identification, scenario development, response training, and emergency operations.

9. Design effective, accurate, and timely feed-

back systems to provide early warning signs of failure and impending crises. A structured management process mentioned earlier can help in focusing attention on regular tracking of relevant and critical indicators to surface the little problems before they become big ones.

10. Be mindful of the social and political consequences of crises or events. Critics, or stakeholders, bear significant influence on project success regardless what the indicators of cost, schedule, and quality show. Learn how to satisfy stakeholders (cf. Mallak, Patzak, & Kurstedt, 1991). Identify one spokesperson as a liaison with the public and prepare a procedure for quick dissemination of information to all affected parties.

11. Become sensitive to indicators of impending project failure. Pay special attention to untracked indicators because these are the most likely to go wrong. Develop antennae and know when the project is going wrong.

12. Adopt a systems view and separate the crisis from the origin of the crisis. Consider the basic good performance principles now popularized as total quality management. Look forward and backward to assess the potential overall effects of the crisis.

13. Choose a project manager indigenous to the country where the project is being conducted. An indigenous project manager will be sensitive to the social and political aspects of the project and its peripheral issues and will catch more problems while they're small or otherwise undetectable to the outsider.

A valuable contribution of a professional society or association (at the committee level) would be to organize a team to design generic tools with directions for customizing each tool to a specific project manager's needs. I believe such a committee would be the appropriate group for effective tool design because they wouldn't have the proprietary concerns that a corporate consortium would have. These tools, such as a checklist for producing a rank-ordered risk analysis, wouldn't give organizations a competitive advantage—they would be shareable commodities. The development of generic tools would improve the quality, access, and cost of emergency management tools used in project management. All organizations must prepare themselves for potential emergencies, and this preparation is scrutinized by the public who expect socially responsible corporate behavior.

These are just a few of my recommendations or strategies for project managers to manage their crises better. The more we focus on the mitigation and preparedness phases of the emergency management model, the less we'll have to deal with the response and recovery phases. And that, I believe, is the best strategy for managing better.

2.2.3.11. EMERGENCY MANAGEMENT TOOLS APPLIED TO DIFFICULT MANAGEMENT PROBLEMS

When we discover our domain is a perplexity, we then know we need to adapt emergency management tools to help us manage.

What we typically term emergency management tools are tools we use to support decisions in uncertain pursuits: perplexities and problems. Once we determine a domain of responsibility is a perplexity or problem, we have an indication we should customize typical emergency management tools to that domain. This module addresses a situation where a holding company (I call it Holding Company) is responsible for a number of divisions, each of which is responsible to operate a government reservation. (I call the divisions Herbert, Sandy, Frances, William, Wesley, and Ingrid.) The term GOCO (Government Owned-Contractor Operated) stands for an organization that operates a government site. I call a previous GOCO at the Sandy site the Chemical Company. I call a comparable site not the responsibility of the Holding Company Ronald. The following discussion explains a real situation and how we should distinguish where emergency-management-type tools (tools designed for problems or perplexities) will help in situations not typically considered emergencies. The discussion is adapted from a letter written to the Holding Company person responsible for all the GOCO sites who asked the question: How do I distinguish management approaches among such vastly different sites?

Summary of the Philosophical Perspective

A crisp statement of the difference in management challenges among the Holding Company GOCO sites is: The sites differ in degree of uncertainty. Herbert (and Sandy) are relatively more uncertain than Frances, William, Wesley, and Ingrid. I define uncertainty as the ratio of the information you *need* for managing well to the information you *have*. So, Herbert has a greater disparity between what you need and have than do the others. More obvious causes of uncertainty at Herbert (higher number of workers, diversity of operations, scrutiny, etc.) increase the numerator of the ratio. Less obvious causes of uncertainty (lower quality information systems, communication, networks, etc.) decrease the denominator of the ratio.

The easy answer to the more uncertain challenges (i.e., Herbert) is to improve information richness up and down the line through better communications and networking, thereby driving up the information you have in relation to the information you need. The difficult answer to the more uncertain challenges is *how* to improve information richness. The how relates to management tools we use to provide information for decision making. Our more-familiar management tools have been developed for managing relatively more-certain responsibilities, like projects and processes. These should work well for Wesley and Ingrid and perhaps for Frances and William. But to manage Herbert, you need management tools similar to those that work for more-uncertain responsibilities, like emergencies or research and development programs. My discussion will focus on tools for 1) improving information and communication, 2) designing complex organizations, and 3) responding to chronic emergencies.

GOCO Sites and Uncertainty

Consider the Holding Company GOCO sites on an uncertainty scale shown in Figure 2.2.3.11.1. As we evaluate each site more,

we'll improve our guess of the relative position of the sites on this scale.

Now consider management's problem-solving task as knowing 1) where we are (WWA), 2) where we want to be (WWWTB), and 3) how to get there (HTGT). Our involvement with different management responsibilities suggests the combinations of knowledge for dealing with uncertainty shown in Figure 2.2.3.11.2.

I've coined terms for the five combinations of knowledge in Figure 2.2.3.11.2. and shown these terms in Figure 2.2.3.11.3.

The key point in all of this is: The management tools managers need for each of these different pursuits (perplexity, problem, etc.) are *different*; and, of course, vastly different at the extremes. So, tools for managing perplexities (where the ratio for uncertainty is high) are very different from tools for managing processes (where the ratio for uncertainty is low).

For any given pursuit, to be successful, we use well-suited management tools to drive the pursuit to a more-certain condition. For example, in a perplexity, we consider and prepare for potential problems. (We help prepare for an unknown emergency by writing plans for alternative possible occurrences and our responses to them.) Likewise in a research and development program, we render the program into one or more projects to get the understanding and results we want. Therefore, if the Herbert site is more like a problem, we want to use well-suited tools to render it more like a research and development program, then one or more projects, and ultimately a process.

Successful leadership styles differ for the pursuits. Task-oriented leadership is more effective at the top and bottom of the scale for pursuits, and relationship-oriented leadership is more effective in the middle. In short, by knowing where our management responsibility is on the scale in Figure 2.2.3.11.3., we get clues to the types of management tools we need and how to best use them.

Causes of Uncertainty

Let's examine the sources of uncertainty at the Herbert site. Start with three factors affecting the numerator in the ratio of information you need to information you have. First, the number of employees you manage at Herbert is large. The increase in number of interactions and therefore the decrease in quality of communication changes significantly as you increase people. Second, the diversity of operations you manage at Herbert is large. There are many different simultaneous operations to manage at Herbert, while sites like William and Ingrid are more focused toward a single mission. Third, the scrutiny you receive from the government and relevant stakeholders at the Herbert site is large. The Holding Company has better relations with stakeholders around the Ingrid site than they do around Frances or Herbert. Factors like these influence each other. For example, great scrutiny of diverse operations means the media's penetration into a problem in one operation at Herbert affects public opinion about an entirely different operation at the Herbert site.

Management Tools for Uncertainty

I believe the Holding Company's GOCO sites range from Herbert being more like a problem to Ingrid being more like a project as shown in Figure 2.2.3.11.4.

The management tools that work for perplexities and problems that we can consider using or modifying for Herbert are: risk assessment, vulnerability analysis, crisis communications, notification schemes, Emergency Operations Center (EOC), table-top exercises, and others. As an example, we can translate the idea of a notification scheme into the need for rapid and effective dissemination of information to the

right people in the right sequence about the right subjects, which is another way of saying notification in a timely fashion. You may need such a tool at Herbert. As an example of another tool, the Management Systems Laboratories at Virginia Tech (MSL) is building an emergency-operations-center-like facility, called an Intelligent Information Center, to support large-scale project management.

In learning about managing emergencies, we've found some are acute (poof emergencies) and some are chronic (plume emergencies). The plume emergency applications are more in tune with Herbert. These tools emphasize information richness and communication needed for plume emergencies.

Dealing with Interaction and Communication

As we consider specific tools and tasks for increasing information richness and communication for Holding Company management and for the Holding Company's stakeholders, we ask the following sorts of questions. How is the communication best done? What information is rich? Communicate with whom? How often? For what purpose? We sort questions like these into what we believe is a closed set by using Figure 2.2.3.11.5. The *precipitator* motivates or causes a need for interaction. The *purpose* defines the expected outcome for the interaction by the *people* who interact. *Participation* describes how people intend to interact on a *problem* of common concern. These five elements set up the physical *process* for interaction and communication we use to get a physical *product* as a result of the interaction. As we consider tools for communicating rich information, often we gather people together and, in so doing, we must factor the elements of Figure 2.2.3.11.5. into the design and use of our tools.

Organization Structures for Supporting Communication

We know characteristics of organization structures that can either reduce the need for information or increase the capacity to provide information, either of which would contribute to improving the uncertainty ratio through organizational design. To reduce the need for information, we can create slack resources or set up self-contained tasks. To increase the capacity to provide information, we can develop vertical information systems or create lateral relations. The easiest thing to do with the greatest return is to create lateral relations. And when we consider affinity groups, field coordination meetings, or other interactions increasing communication across the organizational hierarchy, we're considering creation of lateral relations. One of the objectives of the infamous matrix organization is to have a multi-directional organization so more information flows more quickly in more directions to the people who need the information.

The challenge in implementing lateral relations is two-fold. The first is that you have to gather, store, retrieve, and disseminate rich information quickly and effectively, which means you must have good support systems. The second is that once you start dancing with a bear you can't quit just because you're tired. That is, if you set up lateral relations or use a field coordination meeting, you must get support systems in place and you must follow through or you'll suffer backlash. One management tool for effectively helping manage any pursuit is organizational structure, but the characteristics you place in the organizational structure must be designed to accomplish what you want. For the Herbert site, we want good and timely communication of rich information to the people who need it.

The Holding Company's Management Perspectives

One of the types of tools we consider for increasing information richness and communication is interactions for lateral relations—one-on-one, group, informal, and/or formal interactions. As we consider lateral relations,

information richness, and communications through different interactions, we'll focus on Herbert and the special needs there. When thinking about the Herbert site, we'll consider both Herbert and Sandy to help us keep from overlooking something. We first look at similarities and differences between the Sandy and Herbert sites.

Similarities between the Herbert and Sandy Sites

Similarities between the Herbert and Sandy sites influence management strategies:

1. Herbert and Sandy have many diverse missions resulting in multiple government headquarters organizations having a vested interest (management and budget functions), which increases the opportunities for turmoil, confusion, and disunity. William, Wesley, Frances, and Ingrid have single missions and single government headquarters points of contact, allowing management to be more focused and manage external factors more effectively.

2. Herbert and Sandy are more difficult to manage than the other Holding Company GOCO operations because they have a much larger number of employees.

3. Herbert and Sandy, with large land areas, are always prospects for new government projects or programs and therefore new missions. A new project can be placed at Herbert or Sandy and be a good drive away from all other projects at those sites.

4. Herbert and Sandy have many missions from which they receive constant guidance and direction from a number of federal government agencies. The larger sites receive more attention because they're larger assets for the government. The new government emphasis on centralization is a change in the rules. In the past Herbert and Sandy were more independent of day-to-day government headquarters directions.

   The Holding Company needs to have unified management at Herbert and at Sandy. The missions need to be separated so a problem with one doesn't affect another. For the public who is going to create problems for these missions, how does the Holding Company 1) separate them so a problem with one doesn't affect another and 2) at the same time organize the missions in a unified way?

Differences between the Herbert and Sandy Sites

Differences between the Herbert and Sandy sites also influence management strategies:

1. Herbert has traditionally been the site of multiple prime contractors. A few years ago they pared down from about seven to three. Even today, Herbert has more prime contractors than the Sandy site.

2. There is a greater degree of employee-contractor loyalty at Sandy than at Herbert. The Herbert site has historically had a turnover in prime contractors approximately every ten years. The employees have no loyalty to a contractor, but rather to the site. The employees have learned to be flexible when it comes to what contractor affects their paychecks. By contrast, Sandy was built and operated solely by the Chemical Company, so it became part of the employee culture to be loyal to the contractor. So far, this loyalty has carried over to the Holding Company. At Herbert, the lack of loyalty or unity of purpose could be a barrier to communicating effectively.

3. Herbert is unique because of the number of "whistle blowers." This is a reflection of

the lack of employee trust. At Sandy and Ronald, problems are dealt with internally, not in the media or a politician's office. The Herbert site has such a high number of these incidents that the government agreed to support an independent and unbiased review of whistle blower complaints.

4. At the Herbert site, most of the surrounding population moved to the area and has grown with Herbert. They take interest in and scrutinize everything Herbert does. At Sandy, the surrounding population was sparse and generally poor. They have benefited economically from Sandy and view Sandy as a positive influence in their lives. The way Herbert and Sandy have evolved has caused two differences in management style. First, Herbert managers must be more involved in local community affairs. Herbert management budgets for much larger goodwill expenditures to their surrounding communities than Sandy budgets for theirs. Second, because the surrounding communities display more confidence in Sandy than Herbert, there is a much greater need to involve stakeholders in decisions at Herbert. To make sure stakeholders participate in the right way in the process, techniques such as flow charts can be used to plan and track stakeholder involvement.

5. The Herbert site's mission has changed from production to remediation. The Herbert people are probably having difficulty accepting the new role and change in mission. Employees will not enthusiastically back a mission if they feel completion of the mission means they'll lose their job. There's a lack of understanding among government and Holding Company top management on what's necessary to retain interest and enthusiasm for the new mission. Also, the politicians in Washington, D.C. and at the state level, as well as the public, probably don't have a clear understanding of what's happening at Herbert. The Holding Company should work against a "plant shutdown" mentality.

6. The reassignment of Herbert from one governmental program responsibility to another may be confusing to both the government and the Holding Company. They now have to deal with a new hierarchy of government "landlords" and new lines of communication and direction.

7. The Sandy site has many groups focused on it. The Herbert site has only one group looking at it. That may help Herbert.

<u>Centralizing Authority at Government Headquarters</u>

The government's efforts to centralize authority at headquarters also presents some management issues:

1. The government field office role is being reduced and changed. Traditionally, official communication and program direction to the contractor came through the field office manager. In the past, contractors rarely talked to government headquarters personnel unless they had a field office representative with them. Now, as the government headquarters directly communicates with the contractor, the contractor asks the field office for interpretation, but the field office may be out of the loop and may interpret what the government headquarters wants incorrectly.

   An effort should be made to increase information shared among the Holding Company, the field office, and the government headquarters. There needs to be more of the right kinds of interfaces. The government headquarters information should be shared with the field office and the Holding Company. If not, the Holding Company may

head in one direction and find out months later that the government headquarters has changed direction. Also, the government headquarters may be months behind on important issues the contractor has identified. This lack of sharing of information leads to increased opportunity for miscommunication at all levels.

2. An effort should be made to increase face-to-face contact between the Holding Company and the government headquarters. The Holding Company needs more-direct communication lines at all levels of management.

3. Since the government headquarters has recently reorganized, there is confusion at headquarters, and that confusion simply passes down. There are new government managers trying to make their own mark. New relationships between the government and the Holding Company should be defined soon to result in greater stability in the government management process.

4. The atmosphere of fear and suspicion between the government headquarters and contractors contributes to disunity. The Holding Company position against the recent reorganization initiative by the government further exacerbated the poor relationship between the Holding Company and government people.

Things to Be Considered

There are several things to be considered that might assist the Holding Company management:

1. Improve communication within the Holding Company: more emphasis on the new mission at Herbert; focus on morale and unifying employees (i.e., constancy of purpose); drive out fear; emphasize opportunities for cooperation.

2. Improve communication with the government: focus groups; scheduled meetings for communication; Holding Company representative at government headquarters.

3. The Holding Company should consider bringing together one or more groups to improve information sharing:

   a. Field Coordination Meetings—bring together government program officials, field office managers, and Holding Company officials to discuss responsibilities, expectations, status, and progress (programmatic and budget). Discuss specific problems and solutions. Use status and planning presentations from specific sites. These meetings would help the field office managers in their roles as much as the Holding Company. Another purpose of these meetings is to have the Holding Company and the government redefine their relationships at all levels.

      You should not jump right into a full-scale field coordination meeting, but rather take one step at a time. You may want to begin by using an existing regularly scheduled gathering of your site managers to set up the foundation or the preliminaries to making this field coordination meeting concept work well. Then investigate the possibilities of government headquarters participation.

      Consider coordination meetings for Herbert, at first separate from the other sites. Contractors and government participants in these meetings have special considerations different from the other sites. Then bring all sites together for a joint coordination meeting. Perhaps the other sites should meet together prior to

the joint coordination meeting.

b. Focus Groups—maybe a group like the State and Tribal Government Working Group (STGWG) to look specifically at Herbert. Talk about plans and the mission of Herbert and share frustrations. Try to build trust among government headquarters, the Herbert site, and local political subdivisions like the Indian tribes and the state and local governments.

c. Quarterly Meetings—have the Holding Company GOCO site managers meet quarterly to discuss their problems and lessons learned. Have the meetings rotate among the sites, so they visit every site every year and a half.

Once participants for the groups are identified, the real challenge is to convince the various levels in government headquarters that information sharing is a good thing to do.

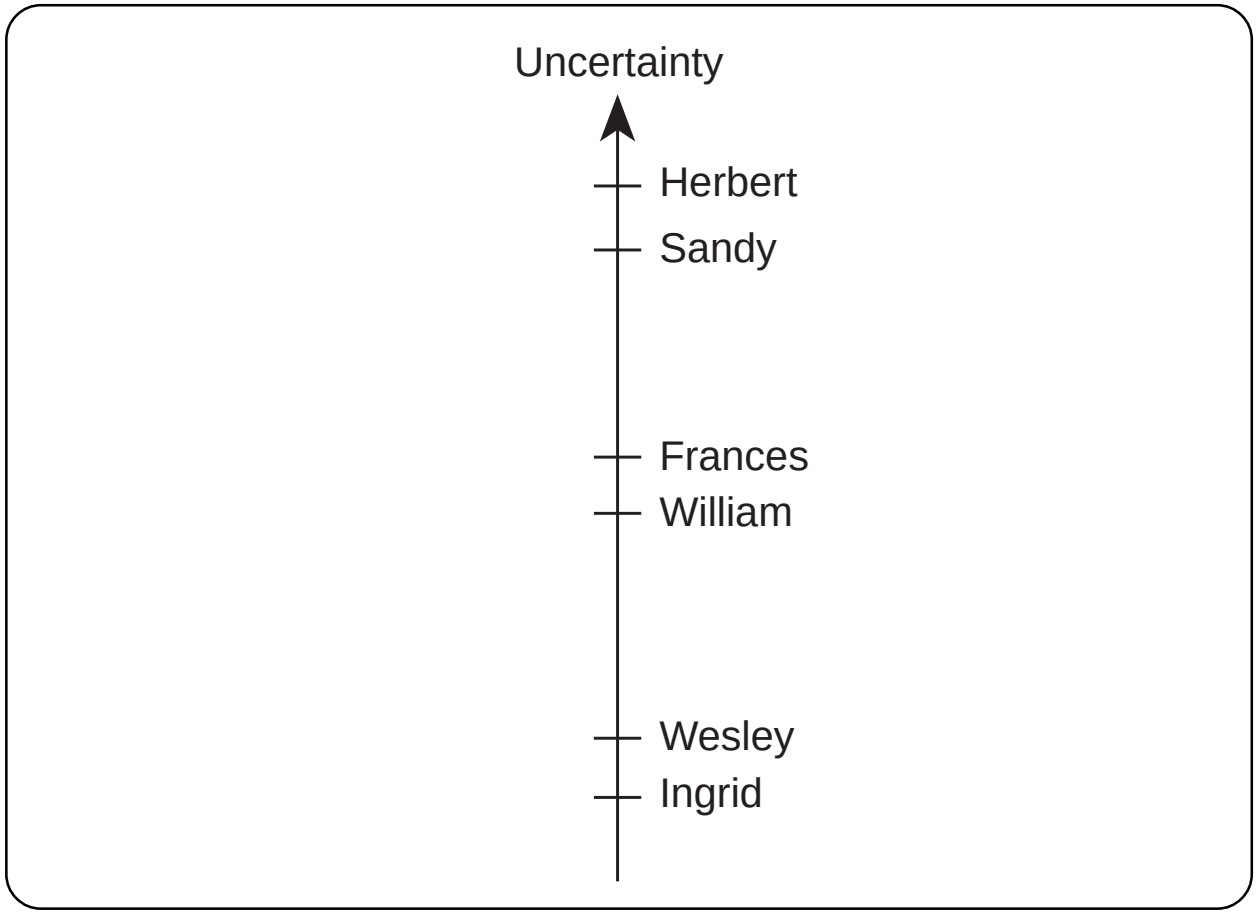

Figure 2.2.3.11.1. *We can contrast the types of management tools best suited to a particular site by comparing the sites according to their uncertainty.*

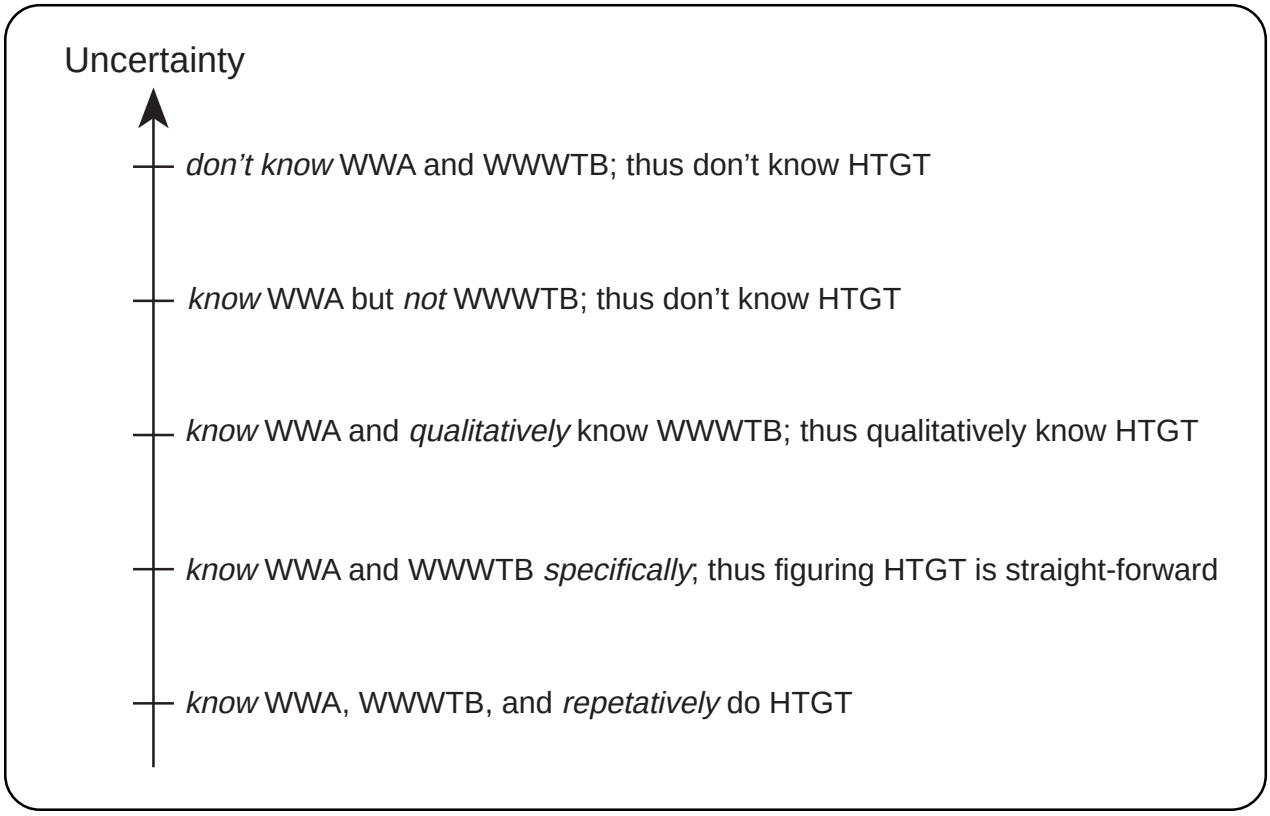

Figure 2.2.3.11.2. *We can convert the uncertainty scale to divisions reflecting how much we know about a domain of responsibility in terms of information needed for problem solving.*

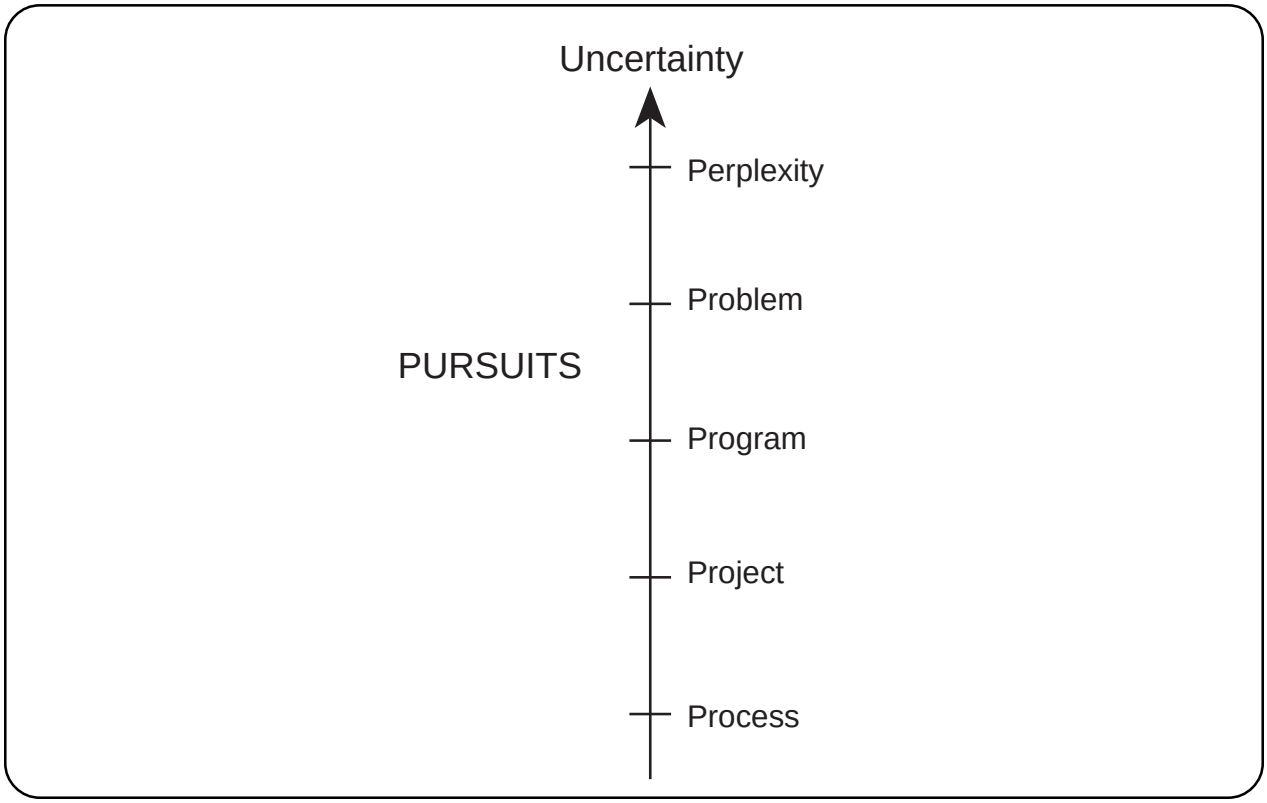

Figure 2.2.3.11.3. *The different pursuits reflect what you know and what you don't.*

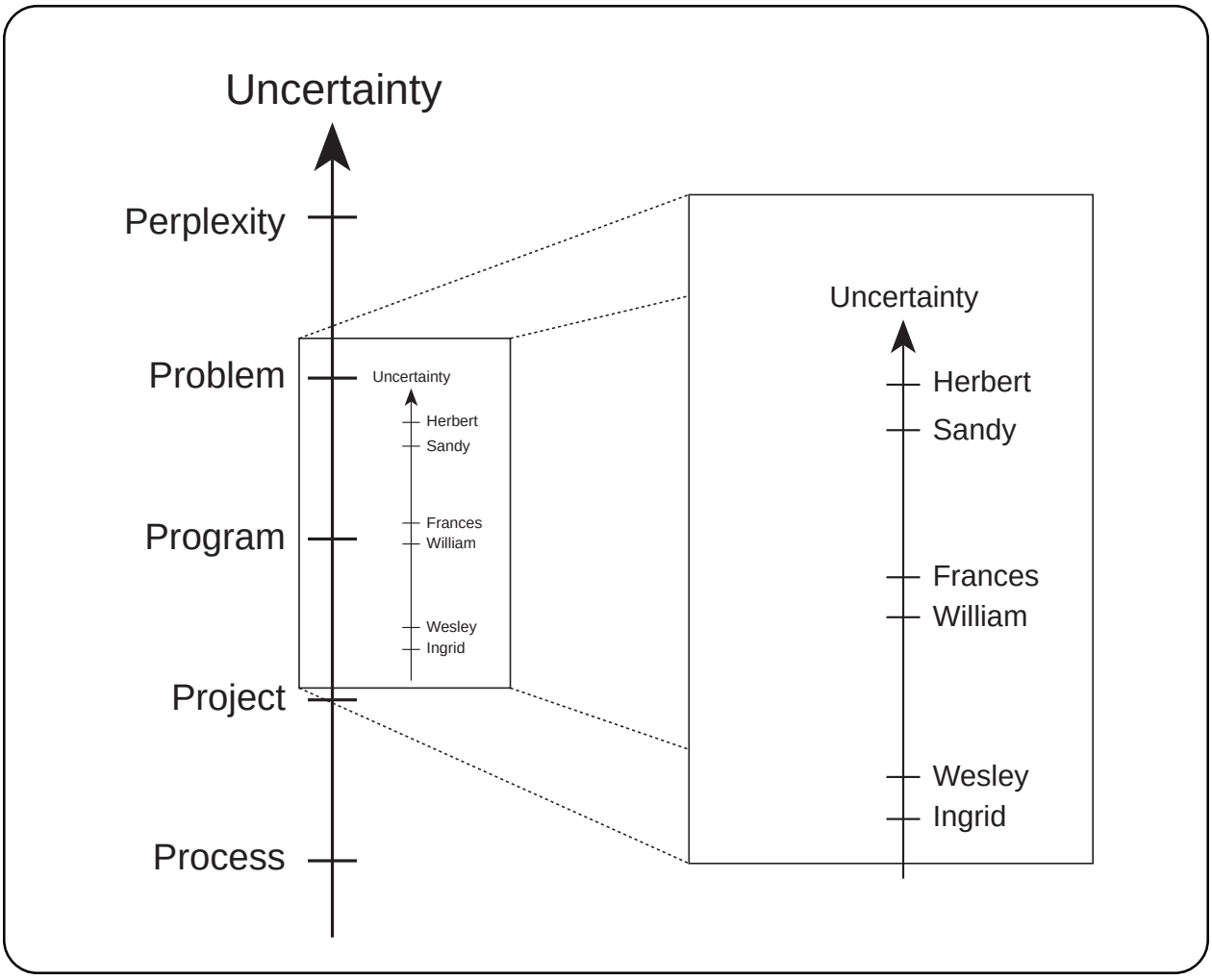

Figure 2.2.3.11.4. *The Holding Company's sites are fit in the pursuits framework.*

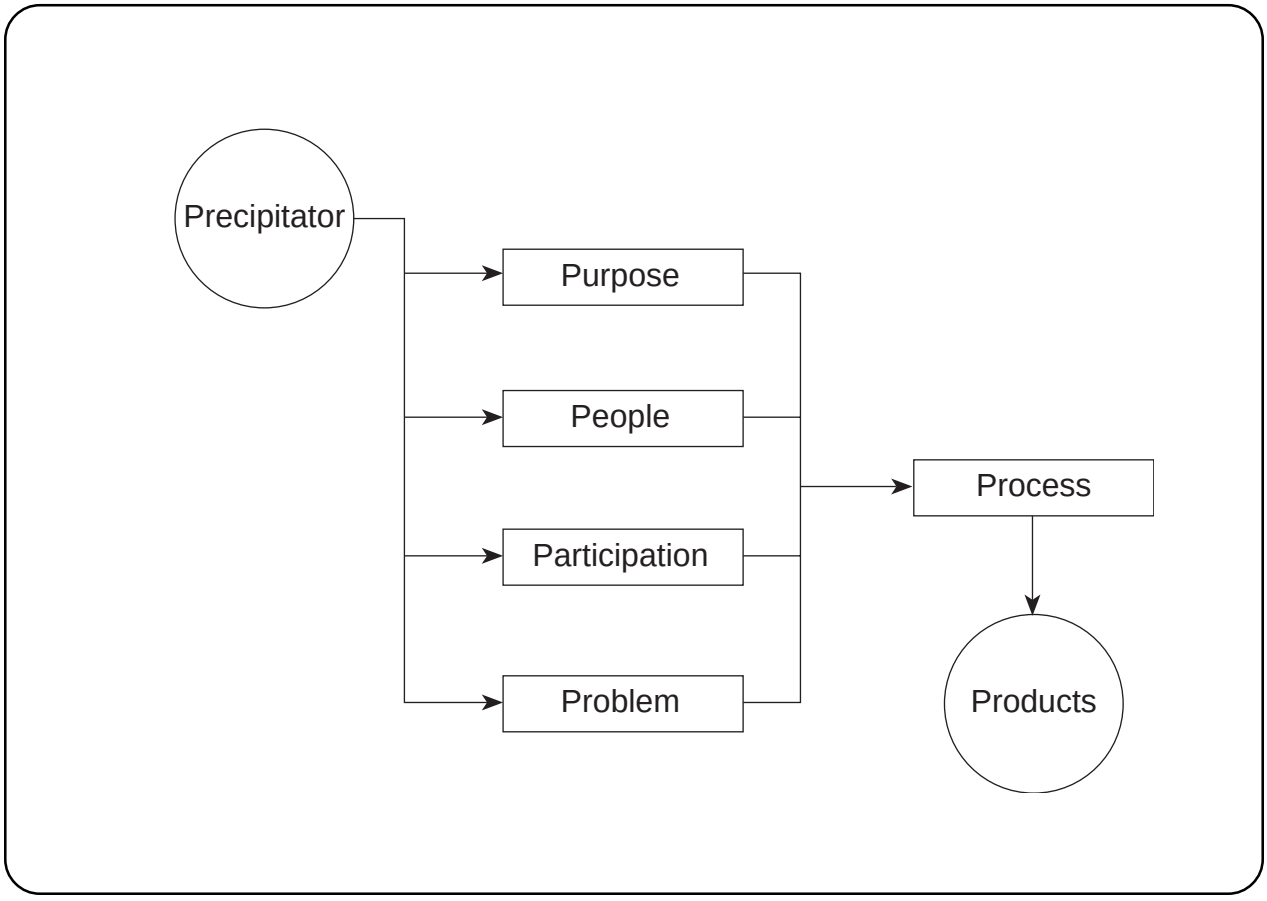

Figure 2.2.3.11.5. *We model group interaction or communication using seven components.*

2.2.3.12. THE MANAGEMENT OF RISK.

We can manage risk by applying management system analysis and management system synthesis.

This module was taken from "The Engineer's Approach to the Management of Risk," *American Nuclear Society's Embedded Topical Meeting on Risk Management.*

From a management perspective, I see risk management, vulnerability analysis, and risk assessment in simple terms. Risk management involves vulnerability analysis, risk assessment, and the relationship between the two. The decisions relating to where you're vulnerable and where you want to assess risk constitute a vulnerability analysis. Morale problems, communication issues, and other influences diverting employees' attention from their work produce areas of vulnerability. Risk assessment concerns the determination of types and related probabilities of an emergency. We can't assess risk on everything everywhere. That's why we do a vulnerability analysis first—so we can focus our risk assessment efforts on our vulnerabilities. I link vulnerability and risk through the evaluation of the consequences of a particular risk applied to a given vulnerability.

In a vulnerability analysis, a manager decides which elements in the domain of responsibility are vulnerable to the effects of any type of potential incident. Decisions for specifying and quantifying the risks to which the domain is vulnerable constitute the risk assessment. In a vulnerability analysis we identify where our domains are open to risk—the weaknesses. The dictionary definition of vulnerable includes "open to attack or damage." Risk, as opposed to vulnerability, suggests exposure to dangerous elements or factors. The vulnerability analysis doesn't tell us what we're vulnerable to; it just tells us where we're vulnerable. I'm addressing risk management decisions in terms of the Management System Model. The risk manager will first want to delimit his or her domain of responsibility. I'll describe a procedure for building and using risk management tools based on the Management System Model (Figure 2.2.3.12.1.).

The processes for risk management are closed-loop processes. See the control loop in Figure 2.2.3.12.1. We first identify where we're vulnerable (domain decision [plant in the control loop]). We follow with assessing types and probabilities of risks associated with those vulnerabilities (disturbance decision [disturbance in the control loop]). Then, we relate these by examining the effect (consequences) of the risk on the situation where we first conducted the vulnerability analysis (disturbances on the plant in the control loop). The linkage between vulnerability analysis and risk assessment is the disturbance on the plant. The disturbance is the risk and the plant is where you're vulnerable. In risk management, managers use and improve vulnerability analyses, risk assessments, and their linkage through testing, evaluating, and modifying their domains under the consideration of a crisis to form a feedback loop (the rest of the control loop). Later, I'll extend the management process cycle of Plan-Do-Study-Act, so popular today in managing quality, to risk management based on the cyclical relationship of risk management processes.

Applying the Engineer's Approach to Risk Management

I focus on two fundamental techniques used by

management systems engineers that can help risk managers better understand their domains of responsibility and therefore practice higher-quality, more-comprehensive risk management. The first technique involves delimiting your domain of responsibility to understand what you manage and what tools you use to manage. I'll introduce the Management System Model and briefly cover the steps involved in management system analysis and management system synthesis.

We all make decisions affecting what we manage. By my definition, then, anyone who makes decisions affecting what they manage is a manager. Managers must know what they manage and what tools they use to manage with. We use the Management System Model (MSM) to define the domain of responsibility for an individual manager (Figure 2.2.3.12.1.). The MSM balances the interfaces between the three components of who manages, what is managed, and what is used to manage. A vulnerability analysis asks you to identify which of your responsibilities is vulnerable. Failure to gain a good understanding of your responsibilities prior to the vulnerability analysis means you'll overlook some vulnerabilities or you'll confuse some vulnerabilities—it all starts with knowing where you're vulnerable.

Once we've defined our domain, we use management system analysis to build management tools for risk management (i.e., decisions about vulnerability or decisions about risk). Management system analysis represents a counterclockwise progression through the MSM, starting at what is managed (Figure 2.2.3.12.2.). Management system analysis has five steps: 1) delimit your domain, 2) determine decisions and actions, 3) define information for decisions, 4) outline data for information, and 5) list measurements for data. When we delimit our domains, we carefully specify what is in the domain and what is not. For example, if what is managed is office supplies, the risks tend to be minimal: paper cuts, thumbtack stabs, etc. But if what is managed is a nuclear power generation station, the components of what we manage present known risks to health and safety (e.g., leakage of underground waste storage tanks; discharge of harmful effluents into the biosphere) that should be characterized in a risk assessment.

In management system analysis, once we've delimited the domain, we should determine what decisions we should make and what actions we should take to manage the domain. The range of decisions we make defines the scope of our responsibilities. We can refer to a formal job description to get an idea of what types of decisions are expected to be made, but there's usually no good substitute for asking the incumbent or having him or her log the decisions made and actions taken for a specified period of time. Work sampling procedures may prove useful for collecting these data.

Identifying the decisions made and actions taken in a domain leads to the next step in management system analysis: determine the information required to support the manager's decision making. Determining information requirements to support decision making depends to a large part on who manages. The manager's cognitive style bears implications for how the information should be portrayed to best suit the manager and support decision making.

Once we've defined the information needed to support the managers's decision making, we must outline the data needed to develop the information by developing the data requirements to generate the desired information. In management system analysis, I view the what is used to manage component as a process

converting data into information for decision making.

This leads us to the fifth management system analysis step—listing measurements to obtain the data from what is managed. We must design measures to capture the data we need in an efficient and timely manner.

Cycling through the management system analysis steps helps you build effective management tools for converting data into information. Risk managers have much to gain from management system analysis if they can use the process to mitigate crises.

Management system synthesis gives us the functions for using management tools. Nine functions, working clockwise around the MSM, characterize management system synthesis (Figure 2.2.3.12.3.). These nine functions make up a structured management process. I group the nine functions into three groups: planning functions, executing functions, and comparing functions. Planning functions address what you want to do; executing functions address what you did; and comparing functions address whether you did what you wanted to do.

The planning functions are: setting expectations, surveying your work, and determining indicators and reference points. Risk assessment and vulnerability analysis work heavily into the planning functions. For setting expectations, we try to identify what could happen and what the consequences would be. Both risk assessment and vulnerability analysis are very strong in setting expectations. For surveying our work, we flowchart potential risks and use cause-and-effect charts for consequences. Defining indicators gives us early warning and detection of incidents.

The executing functions include collecting and logging data, converting data to information, and organizing and presenting information. A tabletop exercise is an example of an executing function. When you look at cause and effect, what you do during that incident is part of the cause-and-effect linkage. You can reduce the effect of the cause by taking the right action. You can increase or make worse the effect of the cause by taking the wrong action.

The comparing functions include reviewing status and progress, exercising personal effectiveness, and verifying performance. In my context, comparing functions encompass learning, improving, and updating risk assessment and vulnerability analysis.

What is the engineer's approach to risk management? I say it's Deming's Plan-Do-Study-Act (PDSA) cycle. *Plan* includes the management system synthesis planning functions; *Do* includes the executing functions; *Study* includes the comparing functions; and *Act* makes the sequence an iterative cycle—the basis of continuous performance improvement.

In risk management, vulnerability analyses and risk assessments make up the *Plan*. Hypothesizing what will happen as a result of the risks is the *Do*. Risk managers using tabletop exercises combine *Do* and *Study* to generate information to improve their risk management processes. Improving the processes for dealing with the risk is *Act*. Then the cycle starts over: What is the vulnerability and risk now that we've taken action to improve our processes?

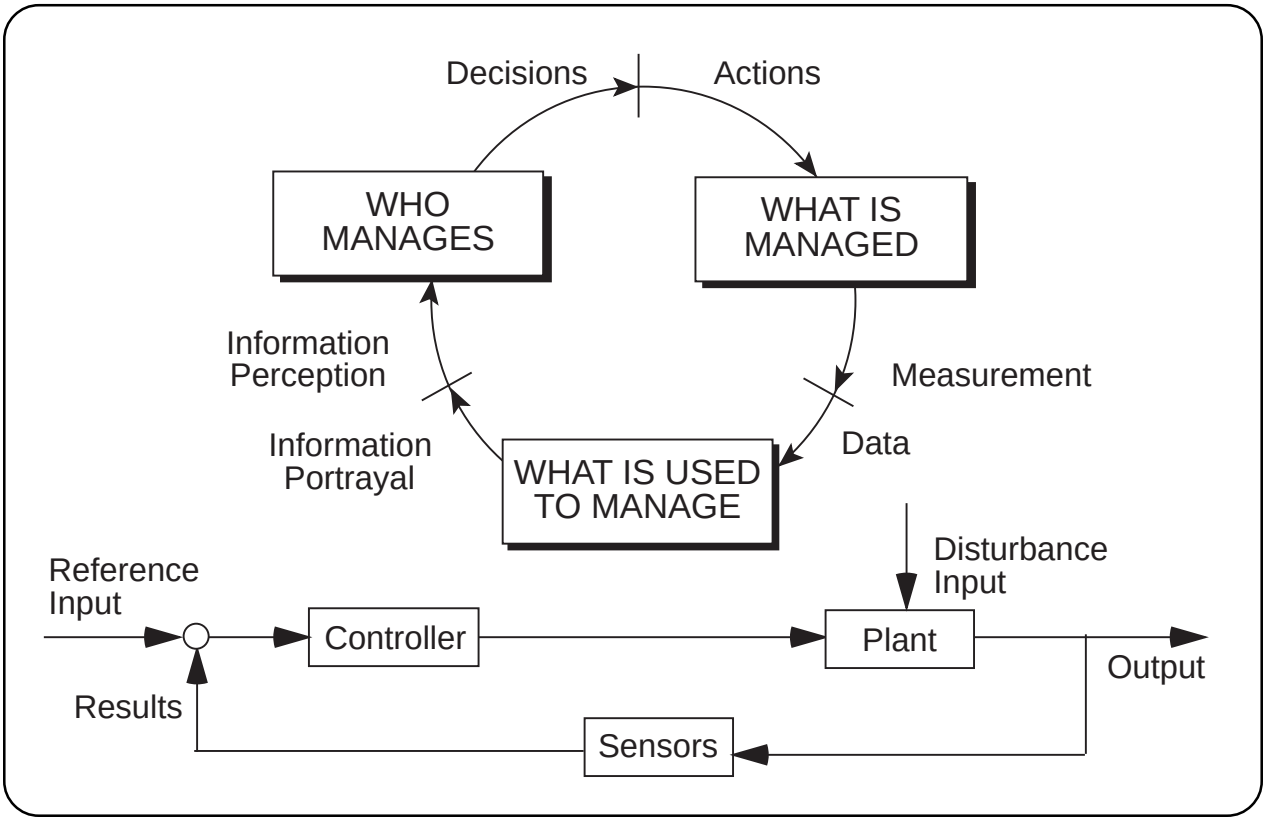

Figure 2.2.3.12.1. *A control loop is analogous to the Management System Model.*

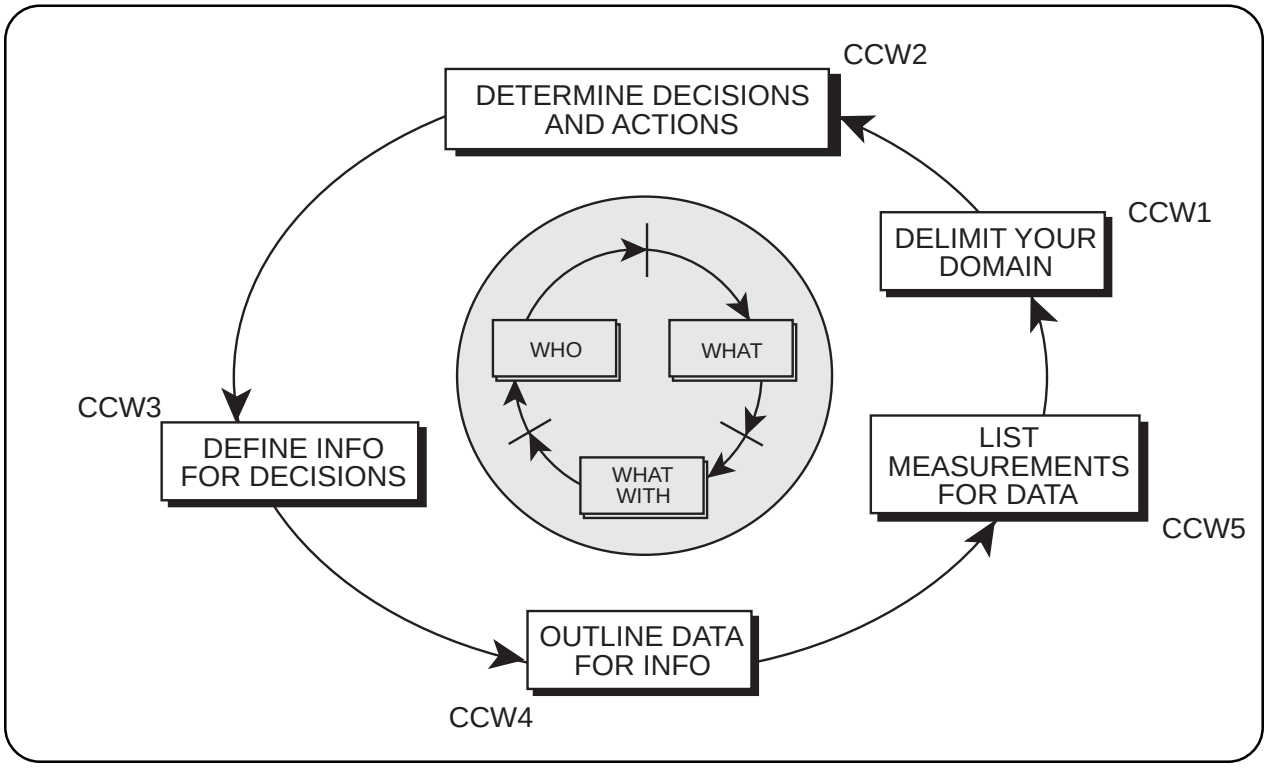

Figure 2.2.3.12.2. *Management system analysis has five steps working counterclockwise around the MSM.*

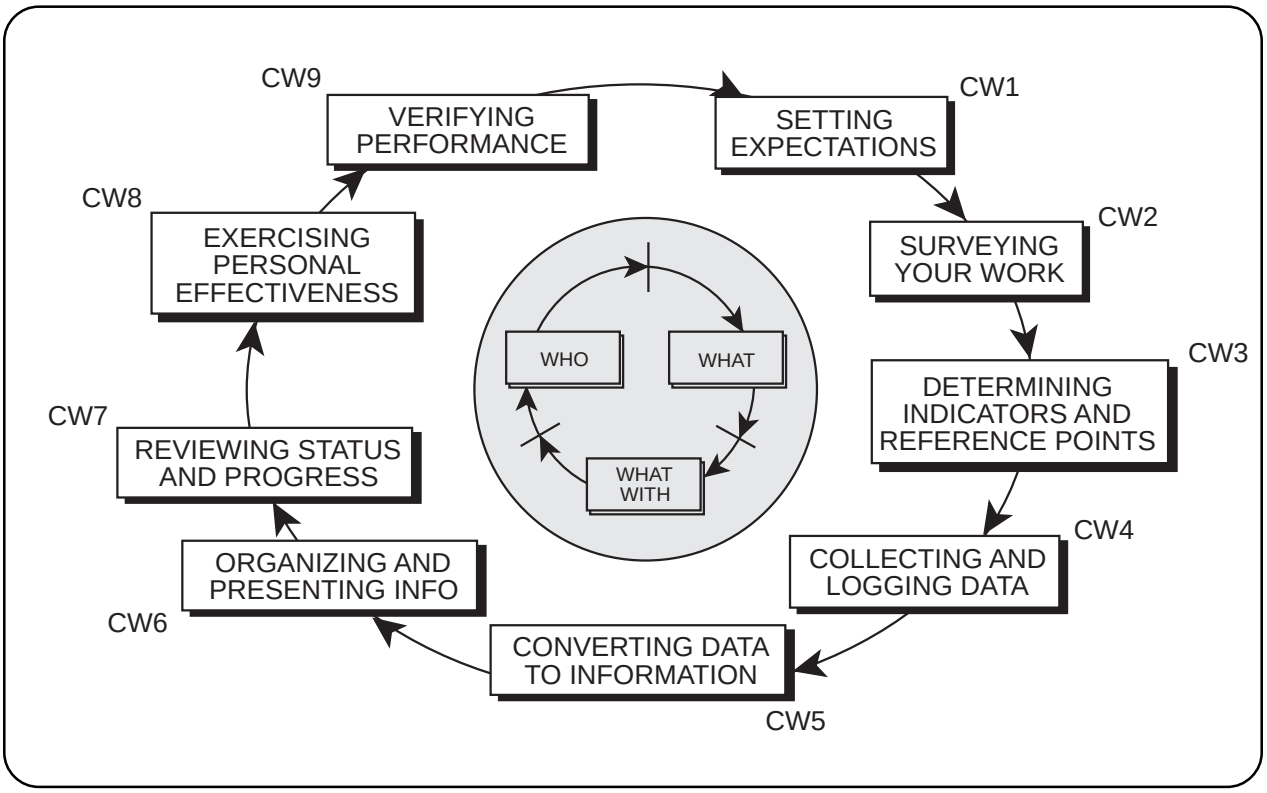

Figure 2.2.3.12.3. *Management system synthesis has nine steps working clockwise around the MSM.*