

Energy and the Environment: Knowledge for Change in a Quasi- Governmental, Quasi-Business Setting

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Environmental management change is currently underway at The Western Area Power Administration (Western), one of four power marketing administrations within the U.S. Department of Energy, a primary power provider for 15 states west of the Mississippi. With the potential for what seemed to be a green solution, hydro-power, jeopardized by drought, glacial disappearance, and species extinction, Western is forced to rethink power generation and transmission. In this context, this project examines new ways of thinking about how knowledge is applied to help managers cope with transition when confronted with the ambiguity associated with uncontrollable change. The research offers a way for managers to understand their role as experts in the midst of changed conditions.

What happens when Mother Nature pulls the plug on what you know to be your job?

To environmental managers everywhere, this question is no longer merely academic. When nature changes, the system for dealing with it has to change, and so the job you knew will change with it. The paper studies the changed working context of environmental managers represented by Western Area Power Administration (Western) who are forced to confront their role and how they approach problems in the face of extended drought conditions.

This project explores how managers can address fundamental aspects of what can be known and understood about their jobs and roles during times of change and transition. In other words, how do environmental managers begin to re-conceptualize their function given the changing natural circumstances and what is being asked of them by upper management? Instead of focusing on rules and regulations brought about by the policies of an agency that can help to deal with change, this paper examines the knowledge of managers in charge since, independent of specific solutions for problems, it comes down to the managers to come up with those solutions when arguing against outdated policies, influencing new programs, and critically examining potential outcomes.

In this context, initial interviews and observations with twelve environmental managers located in the upper Great Plains region show they appreciate, specifically, facing a new situation and having to re-learn their role, purpose and function. Where once they

were experts, they now are near-novices. Yet, they are being asked to pave the way for new concepts in their field, possibly even a new paradigm for how they do their work.

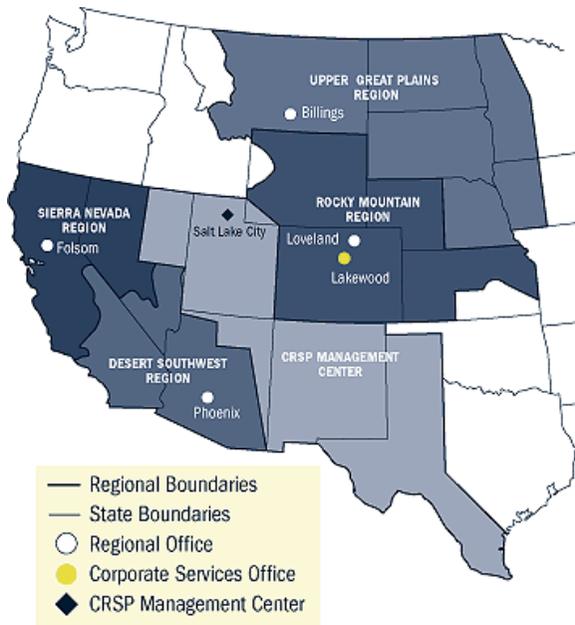
The interviews were analyzed through the lens of Dreyfus and Dreyfus’s theory involving the transition of forms of knowledge when moving from a novice to an expert. The research shows that the environmental managers, once considered expert compliance officers are now faced with provincial conditions of having to relearn and re-conceptualize their function. The project concludes with a discussion on a way for managers at all levels to better understanding what it is they know and how they must transition their way of thinking for a new approach to doing their job and, in this case, manage their own environmental management system.

Background

WAPA Background

Created in 1977 to market low-cost power in the Western United States as a potential management solution to the two headed dragon of energy production and environmental protection, the quasi-governmental agency known as the Western Area Power Administration (Western), has been struggling to survive. Western is barely known compared to its predecessor, the Bureau of Reclamation, which captured the nation’s attention with engineering feats on major projects including Grand Coulee or Hoover Dams (Western 2002). Instead Western was commissioned, along with three other Federal power-marketing administrations, to sell power at cost-based rates – giving preference by law – to consumer owned utilities (Western 2002).

Figure 1. WAPA



WAPA is unique because it is one of the few Federal agencies that provide a flow of revenue into the U.S. Treasury. It is the largest power-marketing administration in terms of service and transmission mileage – providing power to 15-states west of the Mississippi (Western 2002).

Western markets and transmits about 10,000 megawatts of power from 57 hydropower plants. Western also markets the United States' 547-MW entitlement from the coal-fired Navajo Generating Station near Page, Arizona. Western sells about 40 percent of regional hydroelectric generation in a service area that covers 1.3 million square miles in 15 states. Their customers include municipalities, cooperatives, public utility and irrigation districts, Federal and state agencies, investor owned utilities (only one of which has an allocation of federal hydropower from Western), marketers and Native American tribes. They, in turn, provide retail electric service to millions of consumers in Arizona, California, Colorado, Iowa, Kansas, Minnesota, Montana, Nebraska, Nevada, New Mexico, North Dakota, South Dakota, Texas, Utah and Wyoming (Western 2010).

In mid-2005, Western began implementation of a voluntary environmental management system designed to assist the organization in improving upon their environmental impact by moving beyond compliance related initiatives within each region. The main focus of the management system was to provide a standardized approach to environmental activities for purposes of compliance with applicable rules and laws, while providing environmental managers with a more predictable process for assessing and mitigating environmental impacts within their areas. Shortly after implementation, the environmental managers started to realize that the management system, although effective for routine action, may not be up to the task for providing them with the answers they needed given the changed environmental conditions – specifically the tension between generating energy using hydropower in the face of an extended drought that was stressing the natural environment. Faced with this conundrum, the managers were forced to confront their existing role as rule enforcers and compliance experts to strategic thinkers and planners. This change called upon a different set of skills; one that the managers in this study did not seem ready to accept at the time of the interviews and observations.

Western environmental managers are responsible for ensuring compliance with federal, state and local environmental rules. Since Western is primarily responsible for transmitting electricity, the environmental managers spend a considerable amount of time on inspecting vegetative control practices around power lines, chemical management at substations, conducting environmental impact statements, and completing the proper paperwork required of the system. The environmental managers, who are primarily members of mid-management, are routinely in touch with those at the ground level who are concerned with NIMBY (Not In My Back Yard) issues and therefore retain a sense of the impact that power generation and transmission has on the local environment. At the same time, they are also acquainted with the importance of profit and efficiency as being the main concern of executives.

The year 2009 marked the beginning of the ninth year of the longest running drought since the massive dam system was built by the Bureau of Reclamation from 1941-1977 to provide a portion of the power consumed in the west (Western 2006a). "The severe and prolonged drought in the Missouri River Basin has presented many challenges for Western to honor contract commitments to the preference power customers," said Jody Sundsted, Western's Upper Great Plains' Power Marketing Manager (Western 2010). As a result, Western has been forced to confront environmental issues from an entirely different perspective. Low water reserves have significantly stressed the system causing Western to

purchase high priced “dirty” power from coal-fired power plants in order to supplement the reduced energy output from the dams to meet demand. This isn’t a finding readily published or discussed, but can be seen in the steady rise of power prices and growing tension and frustration within the power marketing system. Buying power from other generation sources costs more and has grown beyond the control of Western. As one environmental manager put it, “When the grid needs power – we need to supply it, no matter where it comes from” (Western 2006).

The drought, with its consequences, has raised a number of institutional and policy questions, including the viability of hydro-power, the introduction of other energy generation methods, and it has called into question the role of the environmental manager in shaping and influencing these decisions. When hydro-power was considered superior, those monitoring power productions and its regulation knew what was primary; now that water shortage threatens production; environmental protection is emerging as the *sine qua non* of the industry. The environmental managers are now facing a difficult challenge: Supply is down and demand is up. What they knew to be true about their job – compliance management – is no longer the priority. While their traditional knowledge of science-based requirements of laws and rules and formulas is intact, what has changed is the meaning context of what they know and do. Such concerns for different kinds of knowledges have recently developed in the knowledge analytic (Carnevale and Hummel 1996; Garrett 1997; Hummel 2006a).

Knowledge Analytic

The knowledge analytic focuses diagnostic tools on the fit of different kinds of knowledges (plural!) within the work context and with one another, with special attention paid to distortions caused by inappropriate intrusions by power. The knowledge analytic, in contrast to other knowledge management approaches, does not treat knowledge as a property. As a result, it assumes that knowledge cannot be simply transferred as if it were a piece of land or a chicken.¹

The idea of such transfers may apply to information, but information is not yet knowledge until it is applied in some working context. The definition of knowledge used here is adapted from pragmatists and phenomenologists (*Cf.*, Hubert Dreyfus, Edmund Husserl, Martin Heidegger) under the motto:

Knowledge is the stance we take toward dealing with reality.

Under this axiom, it follows not only that different contexts require different knowledges, but that knowledge is both thought and action combined: it means not only to “have” knowledge but to *be able* to act on it. Information may shape our knowledge and behavior from the outside in; but until someone judges what is to be done with information

¹Knowledge analytics looks deeper into the sources of conflict in organizations and individuals than the usual surface issues raised by organizational restructure, culture wars, personality conflicts, language problems, or politics. Knowledge assumptions are made by all of these; the knowledge analytic opens up these approaches themselves to inquiry about the appropriateness of their knowledge base. This also sets itself apart from most knowledge management approaches (see Agranoff, 2007) to the problems of information technology and artificial intelligence. The problems we investigate include problems of advancing abstraction and quantification of the human work experience, but deal more with general problems posed by late-modern technology. The knowledge analytic focuses on the problems of knowing, authority, and reality from which postmodernism tends to seek escape.

in a specific situation and acts on their judgment, information is only one contributor of many shaping the stance we take in the work place.²

It follows that, barring changes in actual personnel, as conditions change toward more sustainable orientations, environmental managers have to work out for themselves the best way to change their minds and knowledge practices. We can, however, be of some assistance by referring to previous studies and findings. Knowledge analysts and related ontologists/epistemologists have found that:

- Modern organizations are stratified by three layers of knowledges: Workers, Mid-Management, and Executive (Carnevale and Hummel 2006).
- Each type of knowledge is to some extent incommensurable with others (Kuhn 1970).
- The tendency toward incommensurability is increasing, not decreasing (Husserl 1970).
- The entire production universe is heading toward increasing abstraction (Husserl 1970; Hummel 2004).
- A consequence of abstraction is the loss of working know-how as the means by which the system connects to reality, physical or social (Heidegger 1962).
- Solutions require not so much more logic as the ability to make judgments (not decisions), which rests on aesthetics (Arendt 1982).
- The individual as true expert is less rule-bound in his/her judgments and more likely to use aesthetic judgments to diagnose and solve problems (Dreyfus and Dreyfus 1986).
- The organizational knowledge analytic can also be applied to individuals and to the social criticism of society (Garrett 2007; Schmidt 1993; Zingale 2007).
- A neglected capacity in science and society is working judgment as the source of discovery (as distinct from innovation) (Garrett 2007; Hummel 2006).

The Dreyfus Ladder: Return to Novice

To understand the knowledge change of WAPA's environmental managers, the analytical framework of Hubert Dreyfus's knowledge ladder was used. Dreyfus is a Berkeley philosophy professor famed for having tangled with Herbert Simon over the claim of decision theorists back in the 1950s. With his brother, Stuart, an operations researcher, Hubert tackled the type of problem now faced by environmental managers. Dreyfus and Dreyfus offer a five-step pragmatic course of action – asking about the knowledge base of each step – in positing a sequence of moving from a novice to an expert (and back again) to explain how knowledge develops. They identified these stages as the ladder to expertise transitioning from a state of formally knowing the relations of parts of a hypostatized whole to seeing the whole and the parts all at once: what Martin Heidegger called *das seiende im Ganzen* – that which exists envisioned in its totality. Formal knowing, which we learn in childhood, is replaced by an aesthetic feel for the kind of knowing that may lead to the solution of a problem. Dreyfus and Dreyfus (1986) argue that *different* kinds of knowledge characterize the progression of the newcomer to an organization from novice to expert, Dreyfus and Dreyfus (1986) also rejected the claim by Herbert Simon that computers would be able to engage in every and all knowledge operations. Instead, Dreyfus went on to show

²We should note that in previous work we have dealt with knowledges dominant at the different authority levels of the modern organization. The present paper expands that work to specify foundations of knowledge change in individuals. See Hummel 2006b; Zingale 2006.

that expert knowledge was radically different from novice knowledge. Where Simon had posited a range of only quantitative differences in one kind of knowledge spread out on a range, Dreyfus pointed to sharp breaks between knowledge operations and showed that different knowledges were in operation (Dreyfus and Dreyfus 1986; Hummel 2002).

This conceptualization makes a difference. Had Simon been right, learning new methods of working would have been indifferent at different stages in the life-cycle of individuals exposed to change. Dreyfus's distinction between kinds of knowledges used in developing working skills not only supports the contention that there are several different kinds of knowledges but that large parts of each cannot be translated into any other kind without serious loss of content.³

To Dreyfus and Dreyfus the pinnacle of expertise was reached at the point of total immersion in a specific task. For example, the carpenter could be an expert at crown molding, but not at knowing-how to sell his services, manage accountancy, or teach others his skill. Expertise to Dreyfus and Dreyfus stopped at the level of knowing-how to do a specific task without considering the context of a broader objective. This leaves the problem of knowledge barriers within organizations unsolved. An argument is made here that having know-how is exclusive to someone being proficient in the task, while expertise means being able to apply the proficiency to other tasks. Contained in this argument is the solution to the knowledge barrier problem. For an organization to succeed, expertise must encompass all forms of knowledge.

Method

A series of informal interviews with twelve environmental managers from the Upper Great Plains region of Western were conducted over three days at their regional planning meeting. The purpose of the interviews was to explore and better understand potential challenges associated with environmental management activities identified and discussed previously at Western's All Environmental Annual Conference in Monterey, California. The focus of the interviews was to identify where on the Dreyfus ladder the environmental manager's knowledge of how to deal with the drought challenge could be located. The Upper Great Plains group consisted of the environmental managers working in the region at the date of time of the interviews.

Design and Procedures

The informal exploratory nature of this project requires no guidelines for determining the size of purposeful samples (Patton 1987). This logic is based on a group large enough to provide credible evidence, yet small enough to permit adequate depth and detail for each case (Patton 1987). A mixed form experimental design was used that employs naturalistic inquiry. The subjects were asked questions in four categories: (1) general description of their knowledge of environmental management at Western, (2) related interpretation of the

³Here may be the difference between knowledge management and the knowledge analytic. Knowledge management may never get to translating between knowledges, because for it no different kinds exist. However, in public administration, Robert Agranoff has noted, "Knowledge is broader, deeper, and richer than data or information" (Agranoff 2006). The words of Davenport and Prusak (2000:6) sound good: "Knowledge derives from information as information derives from data. If information is to become knowledge, humans must do all the work" (cited in Agranoff 2006). We would say that these terms belong to radically different kinds of knowledge.

meaning and purpose of their job, (3) hypothetical situations, and (4) theoretical.

Instrument

Questions for the interview did not follow an interview guide; but instead permitted the flow of discussion to structure the informal interview process by directing the procedure and timeliness for specific types of questions for qualitative research (Patton 1987, Patton 2002). Observations in the field included looking and listening, observing and interviewing. Field notes were gathered via note taking. In addition, subjects were observed during the interview process to gather vague and over-generalized information.

Analysis

Interviews were interpreted by identifying coherent and important examples, themes, and patterns to the data. This was accomplished by looking for recurring themes. Quotations and/or observations that went together were linked. An inductive analysis of specific quotations or observations was completed using a cross-classification procedure designed to “flesh-out” categories. This provides categories for discussion and evaluation by crossing one typology or dimension with another. The data were summarized according to emerging categories by providing rationale for the category and supporting documentation and analyzed using the Dreyfus and Dreyfus model of novice to expertise.

Table 1. Novice to Expert Framework (Adapted from Dreyfus and Dreyfus)

Steps	Description	Car example
Stage 1: Novice	<ul style="list-style-type: none"> • The practitioner follows context-free elements by following context-free rules. • Judges performance by how well the learned rules are followed. • Feel little responsibility for outcome. 	<p>Shifting gears based on car speed without regard to the situation – context-free.</p> <p>Measure: successfully shifting to the next gear at the correct speed.</p>
Stage 2: Advanced Beginner	<ul style="list-style-type: none"> • The practitioner, through experience, begins to realize that situational elements arise that require new rules for behavior that may now refer to both situational and context-free components. • Judges performance not on following rules, but also incorporating situational knowledge. • Feels little to no responsibility for outcome. 	<p>The car driver begins to use situational engine sounds as well as context-free speed in gear-shifting.</p>
Stage 3: Competence	<ul style="list-style-type: none"> • The practitioner becomes overwhelmed with the number of recognizable context-free and situational elements present in the real world. • A sense of what is important is missing from the rules. 	<p>The car driver no longer focuses on shifting, but instead drives with a goal in mind – getting from point A to B.</p>

Steps	Description	Car example
	<ul style="list-style-type: none"> • Judges performance by identifying a goal and working a plan intuitively. • Feels responsible for, and thus intensely involved in the outcome. 	<p>However, still drives with little concern for driving conditions, scenic beauty or passenger comfort.</p>
<p>Stage 4: Proficiency</p>	<ul style="list-style-type: none"> • The practitioner is deeply involved task and experiencing it from a specific perspective. • The practitioner’s perspective influences salient features of a situation. • No detached choice or deliberation occurs – the activity just happens, but changes in the activity are analytically and consciously evaluated. 	<p>The car driver intuitively understands the speed of the car (feel for driving) in relation to driving conditions and consciously decides what to do next – i.e. shift gears or apply brake, or speed up.</p>
<p>Stage 5: Expert</p>	<ul style="list-style-type: none"> • Knows what to do based on a mature and practiced understanding. • An expert’s skill has become a part of who they are. • Experts don’t solve problems and don’t make decisions; they do what normally works. • Deliberation does not focus on calculative problem solving, but rather reflecting on one’s intuition. 	<p>The car driver is no longer driving the car, but is completely immersed in the essence of driving. Speed adjustments take place without thought and multitasking with other activity is probable.</p>

Findings

Findings from the interviews suggest that the Western environmental managers are wrestling with what is expected from them. As stated succinctly by one environmental manager, “Our job used to be compliance, now I’m not sure what it is we are supposed to be doing. They [upper management] want us to make sure we are in compliance, but I’m not sure if this is enough anymore” (Western 2006). The environmental managers understood the meaning of their job to be consistent with successfully administering rules and working internally to see that the rules are followed. What has shifted is the concept of the rules. The rules that used to apply, no longer solve the challenges they now face.

At one point the interviewer was standing with a manager on top of a great dam. The manager said, “We are supposed to make sure that the pallet sturgeon [endangered fish] is protected. Look at this dam.” He pointed toward the water behind the dam. “This area used to be the water bypass [excess water that goes around the dam when flows are sufficient]. The bypass is completely dry. Water levels are down over 15 ft. at this point in the Missouri. This dam is operating at 40% capacity and it is the uppermost dam in the system. Imagine this problem on every dam down the Missouri. How are we supposed to protect the sturgeon [and meet energy demand] when there is no water? Perhaps some species are meant to vanish” [environmental manager] (Western 2006).

In response, some have chosen to ignore the problem altogether - "The water problem is out of our control." Some have chosen to work within the system - "The rules need to change to reflect what is happening." Others have chosen to confront the system - "Our environmental management system needs to move beyond compliance." All agreed: that they need people thinking about environmental issues from a new perspective and asked, "How do we get people at Western to understand these [environmental] issues when we are having so much difficulty meeting energy demand?" [environmental managers] (Western 2006). This was a topic discussed in open format in a group session of the environmental managers. A solution to the problem never materialized at this regional meeting. The unsatisfactory outcome illustrates the complexity associated when defining the meaning of a problem. The environmental managers have a choice for how they approach the issue: (1) save the fish or (2) generate energy without harming the environment. The way the problem is defined frames the possible solutions - (1) the save the fish frame reduces the problem to a water and energy conflict; while (2) generating energy without harming the environment opens up the field to new concepts and ideas.

Beyond the Dreyfus Expert

The interview findings illustrates that the managers are well aware of the changing environment and requirements, yet there is an ambiguity about how to deal with it. The environmental managers know how to do their work to comply with regulations but really knowing their work would mean being able to apply knowledge to the changing conditions. This vicious division of 'knowing how to do it' and 'knowing the work' was first described by Frederick Taylor in dividing knowing and working in scientific management. Know-how is considered by positive science to be a mere ancillary derivation from knowledge. In phenomenology this axiom is reversed: What gives knowledge its focus is that it is a narrow but pointed derivative of know-how, which remains the primordial source for formal knowledge.

The feeling of knowing-how – the sense that one is capable of – is so much a part of everyday experience that its availability is often taken for granted – we just know-how without thinking about what to do. Changes in know-how require us to re-learn and experience a phenomenon from an entirely different contextual framework. Consider that the novice is a student of environmental management. The person lives in a state of discontent, unable to understand how the expert can do what they do. The student is capable of studying environmental systems, but only from the distance that science permits. Discourse is highly rational and reactionary as the novice's desire to learn more is evident in their analytical approach to gather scientific data. The student is the experimental scientist creating theorem with a serious disadvantage of not knowing what they don't know. As a result, the novice can become easily fooled into being convinced that they know more about the phenomenon than they actually do – the term ignorance is bliss comes to mind.

The environmental managers at Western have been shaken from their expertise role as environmental compliance officers and are now being asked to re-think their job role as strategic environmental and sustainability planners. There is a sense that the same skills used to shape their compliance expertise can be applied to solve this new problem – "what we need to do is write new policy that states that Western will not buy power from dirty coal plants" [environmental manager] (Western 2006). They are somewhat insensitive to the pressures and demands felt elsewhere in the power marketing system. The novice solutions often risk addressing the issue without taking reality into consideration. Ideas and

theorems that are created border on the superficiality and often appear grossly simplistic. Quantitative data, facts, figures and statistics are the tools of the novice. There is even a sense of denial with the problem at hand – “If we get a good snow pack this winter and rain this spring the problem should go away” [environmental manager] (Western 2006).

To some degree the novice/advanced beginner provides a foundation from which to develop. The trouble is that the foundation continuously shifts as the novice/advanced beginner begins to learn more about the phenomenon. This is often met with a sense of being stuck or as one environmental manager stated, “We don’t know what else to do, so we just go on doing what we’ve been doing...filing reports, hearing complaints, conducting inspections. At some point, they [upper management/policy makers] will make a decision and leave it to us to figure out how to implement it.”

What these environmental managers have yet to figure out is that management is not just looking to them to implement the decisions under these changed conditions, they are calling on them to be part of the solution building. As the regional director noted, “they want us to figure this out and offer suggestions...what we need from them is some idea on the policy direction.”

How is it that these groups become “unstuck” when working through a transition toward reasonable and practical solutions? The initial thought was that an organized and systemized approach in the form of a top-down environmental management system might be a correct tool for the problem. Yet, the solutions remained elusive and Western continued to search for an approach that would simultaneously address the role of the environmental manager as a rule bound technician with the capability of thinking creatively about unique solutions to regional problems. This mix can be captured in figure 2.

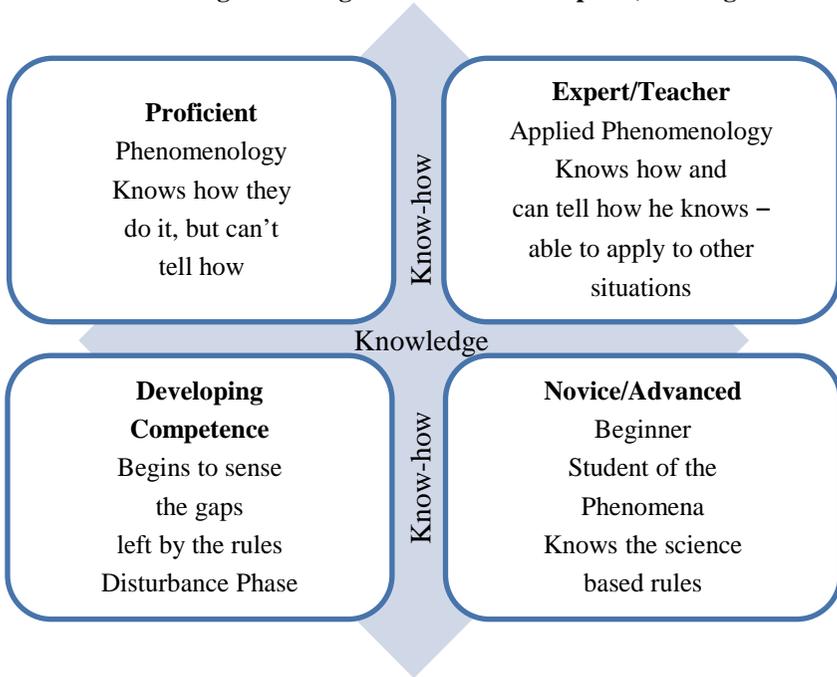
Discussion

The reason a solution appears unattainable to the Western environmental managers is not because they are having difficulty understanding what is at the technical and bureaucratic foundation of the problem. They understand it quite well.

What they don’t understand is the action side of knowledge. In other words, you can “know” something and not know what to do. This was already recognized by one of the earliest explorers of how science works. Immanuel Kant pointed to typical situations in which an attorney, a physician, or even a statesman knew the general rules or even laws of jurisprudence, medicine, and statecraft, but was unable to recognize cases where these might apply. Kant called this lack of judgment by its popular name: “stupidity.” (Kant 1965, B 173/ A 174; Hummel 2004)

Returning to the definition of knowledge as the stance we take toward reality, the knowledge analyst would ask what action is implied in his knowing. The managers know alright, but they don’t know *what is the action that is required from them; in other words, the new stance that is required of them*. This, to follow Kant, demands a certain sensibility to judgment, which no amount of practice or experience can fully make good.

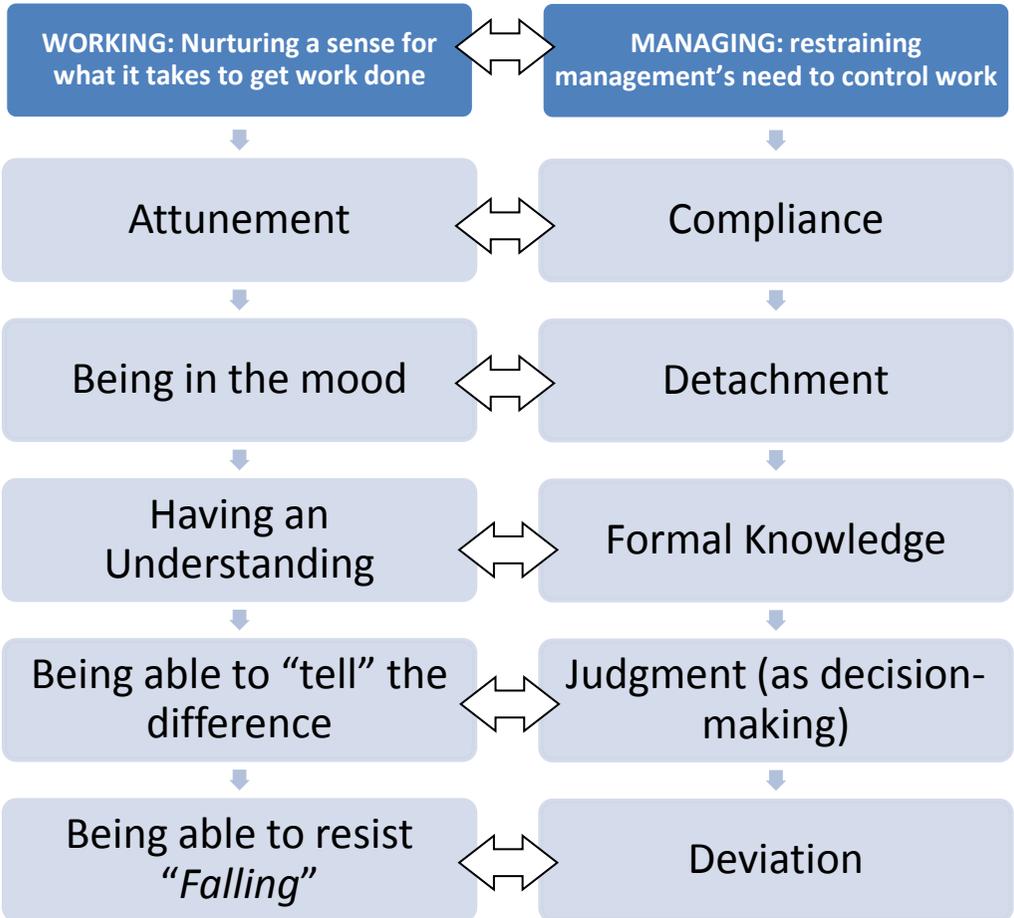
Figure 2. Phenomenological Change from Novice to Expert (knowing/know-how)



The underlying problem is not one of process, rule or control, which is the foray of the existing environmental management system. Instead, it is one of apt conceptualizing of the current relation between self and knowing as both having a handle on things and having a sense for what is doable, knowledge and action. And, since these relations can never be fully known in the particular event by the general theories of science, the changing situation requires the ability to sense the appropriate way of action even before it can be tested. The following provides a discussion on a way for workers and managers at all levels within Western to understand their professional problem of environmental management from a knowledge perspective, which is to make sure that the conditions for nurturing a sense for what it takes to get work done (left hand side in the chart below) are provided and restraining management's need to control work (the right hand side) are minimized.

The left summarizes, in Heidegger's terminology (via Dreyfus), the orientations of the worker as juxtaposed against fears of the manager (at right). Ideally, the fundamental aspects on the left would be built into the environmental management system to create conditions for transitioning from expert compliance managers to that of strategic thinking and planning.

Figure 3. Working and Managing



Attunement is more about knowing what to pay attention to when framing choices - it raises questions and opportunities to create dialogue on fundamental beliefs, such as, how committed is Western and the managers to environmental protection. The notion that Western is willing to purchase “dirty” power or even suggest wiping out a species to generate power alludes to, at the very least, the complexity for dealing with what it really means to be an environmental steward as an indistinct concept. This is in contrast to a compliance mindset, which implies clear and distinct objectives. The feel for the work is replaced by the logic of the job, adherence to clear and distinct work processes that may or may not create the conditions for discretion. There is more of an attitude for control and stagnation of thought, such as asking an environmental manager to reapply existing rules within the context of the changed conditions in order to continue to use hydro in a responsible way.

Mood lightens or darkens the event, it can be favorable to the work or not. We do not *have* moods; moods have *us*. At Western, the mood of the environmental management system can be one of involvement and more conducive to transition, exploration, discovery and engagement. Conversely, the system can be viewed as a method to detach the managers from the situational conditions and focusing more on efficient reporting and processes designed for a specific group.

Having an Understanding has more to do with developing the skill to be good at something as it relates to what is already there. For example, one can know how an ecological system works and begin to apply this to energy generation. This level of understanding extends beyond having mere knowledge of a system and involves knowing how to situationally respond to changed conditions. This sense of knowing one's way around the work and being able to do it is often denigrated by those separated from the work as either incomplete/partial knowledge or falling short of knowledge. In other words, an environmental manager may simply do what needs to be done and then be confronted with the task of trying to formalize this knowledge as justification for action within a management system. The formalizing of the knowledge must be accepted as always partial and never whole because situations are separated in time and space and identical social conditions are rarely, if ever, repeatable.

Being able to "tell" the difference between ways that will work and ways that won't. This concept conceives of telling as developing a feeling for the work as a continuous process of adjusting to the ambiguity of changed conditions by being able to tell when the work is going well. Note: this is not yet communication, but instead a feeling for where the person is in their work and then allowing the person ample space to make the necessary adjustments to fine tune, refine or entirely re-adapt to new conditions. This form of judgment as a feeling can be contrasted to the formal processes for judgment within an environmental management system which often seeks an exercise of compelling logic, as though decision-making is a choice between clear and distinct alternatives. This is most evident with the WAPA environmental managers when asked about the effectiveness of the environmental management system – one manager responds – “To what end are the means of the system to justify? Are we supposed to become more efficient at filing reports and reporting deviations or are we supposed to use it to help protect the environment?” This confusion points toward ambiguity operating at multiple levels with Western – one at the level of system processes, the other more fundamentally at the level of system purpose. A system designed exclusively as a rationale process for decision making may miss the power of intuition brought about by what happens at the edges of logic when one can tell (have a sense for) whether something is working and what to do next.

Resisting Falling means being authentic is designing one's own work, even when the job design is imposed by someone or something else, in an effort to avoid falling in with the conventional standards of others. Obviously most management objectives work against deviations from the norm or pulling away from conventional standards. It is believed that efficient systems control deviations and manage tolerances, but is this what is really needed when a complex system finds itself in the midst of external pressure for change? Control, or the illusion thereof, may be the desire of management and associated management systems, especially during transition; however, what really may be needed is a break from traditional norms. What the environmental managers are really being asked to do at Western is to avoid falling in with the past conditions and standards that created the current situation and to think differently. According to the environmental managers, Western upper-management desires changes, but may in fact be simultaneously working against themselves

within the confines of an atrophic environmental management system designed to have the environmental managers as compliance experts.

Conclusion

Considering the situation that Western finds itself in, new knowledge is required. If reality changes, the stance towards reality needs to change. What managers in a changing task environment may not initially realize is that a change in task often requires a return to being a novice, rather than an expert. Not aware of how they became an expert to begin with, or having put personal growth behind them, they may not be aware of the reversion to an earlier kind of active knowing that is required in task change. What can a manager expect when sent back to a near-novice level of knowing in dealing with a changing reality?

Here we arrive at the knowledge base of the expert. What can justify his or her outstanding characteristic: namely, the sense for the whole? While this is usually the end of any scientific inquiry, we need not be intimidated by this apparent dead-end. The position of finding oneself between two paradigms, in this case – the function and purpose of a management system for environmental protection, has been well described by a number of scientists.

One example is cited: Richard Feynman in writing to James Watson about criticism of his book *The Double Helix*. An adaptive science, and an adaptive management, will learn how to be sensitive, in Feynman's words, to "the beautiful and the sublime." Science itself has the answer to this demand. What is required is a return to science. Science itself was, and continues to be, originally based on observation.

In many applied fields, science has become the routine use of established concepts. Established concepts require distinctness and clarity – otherwise we could not calculate with them. But there is also another side to science: observation. And observation requires sensibility to perceptions that are emerging – still indistinct in not being separated from one another and confused in the sense of being fused with one another (*Cf.*, Werner Pluhar, "Translator's Preface" to Immanuel Kant, *Critique of Judgment*, p. xlix).

Failure to be attuned to what is on the way, but still emerging, leads to events like *Challenger* and *Columbia*, failed responses as in *Katrina*, inability to organizationally grasp warnings of attacks on Oklahoma City, New York City and Washington, D.C., neglect of issues like global warming and the decline of entire industries like that in Detroit.

The training of the Western environmental managers, and their own rethinking, will require openness to emergent facts and critical skepticism about established concepts that conditionally shape policy and policy interpretation and practice. This is an issue for the ambiguity associated with aesthetics, not narrowly applied linear logic. It requires an approach that not only asks more of the workers, but does so in a way to create more freedom with less control, more involvement with less separation, more understanding with less formality. Ultimately they must develop a greater sensitivity to the fact that the workers know something that management doesn't about how policies and programs are shaped through implementation and what can be known, even if they can no longer consider themselves experts within the changing conditions.

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