GETTING THE WORD IN VALUE ENGINEERING AND GETTING IT OUT

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ABSTRACT

The knowledge process (including creation, dissemination, and utilization) is discussed in relationship to Value Engineering (VE) theory and practice. This paper presents a conceptual framework to guide development of the management of innovation. Concepts and issues from diverse social science disciplines are combined to develop an interdependent set of critical concepts. The issue of diffusion receives special emphasis, including a review of potential obstacles and suggested dissemination strategies. Finally, the performance of both value-theorist and value-practitioner roles is advocated.

INTRODUCTION

We often hear that we are living in the "Age of Information". Information production, storage and use in many disciplines are exploding while users are fervently trying to keep pace. Among SAVE members, it is generally agreed that information about value analysis is greatly underutilized and that increased use of the value techniques would significantly redound to the public good. Three of the major obstacles to increased use of knowledge by decision-makers include: (1) knowledge doesn't exist, (2) decision-makers are ignorant of knowledge that does exist, and (3) decision-makers know about the knowledge but refuse to utilize it. This paper examines some of the complexities of knowledge creation, diffusion, and utilization in VE.

KNOWLEDGE CREATION

Theory building in any field involves "both the development of propositions designed to explain relationships between phenomena and the efforts to confirm or refute these posited relationships by empirical means, either descriptive or experimental, as opposed to untested or speculative models."[1] There are three major models of how theories develop. In the "ivory tower" view of theory development; theory stands alone, separated from practice. In the "rational" view, theory guides practice. Finally, from the "iterative" perspective, practice and theory are reciprocally interdependent. That is, theory is used to formulate and refine theory; which in turn, guides practice. The iterative approach seems the most appropriate description of Larry Miles' approach as he developed the VE principles. Further, Miles' thinking was influenced not only by the state of empirical knowledge regarding the problem area, but also by impending events in the real world. Those are important attributes that should be central to all of our practice. While many practitioners do view the advance of the technique as an important function, too many of us settle with implementation alone. I am not advocating a solely applied approach to theory building in VE. Many questions will be answered in non-practice contexts where better control is possible. However, many of the most important questions have arisen from observing VE studies and practices, and from the problems teams have encountered.

To be considered useful scientific knowledge, content must contain: (1) a broad view of the phenomena to be understood, (2) adequate indicators of important system changes, (3) controlled studies that produce strong inferences and generalizable findings, (4) replicatability, and (5) clear reporting or writing. All too often, researchers (including those involved in developing programs like VE) focus on one small area of inquiry and develop distinct (unrelated) and specialized knowledge domains within the discipline. Each area provides an incomplete theoretical model for planning practice, generally neglecting the issues of acceptability of the method to practitioners and difficulty of implementation. Clearly, if the method is not implemented at all or is implemented incorrectly, it will not have the desired effect.

In many ways, VE study falls short of meeting the above requirements — there are few people working in the field of knowledge production for VE and those who are must do it with limited time and support. The lack of time comes from competing responsibilities of the VE practitioner within his or her institution; while the lack of support, both locally and nationally, comes from a lack of institutional belief in the payoff and usefulness of the potential findings. This situation results in a number of consequences or obstacles to the growth of our field — inadequate development of indicators of effective practices, studies of convenience, and very few articles or monographs.

Hundreds of papers have been published in VE since it's inception, but these papers, as a whole, are best characterized as a collection of bits and pieces. There is little unifying focus across areas of inquiry. With most authors working in isolation, there is a lack of obvious effort to link various areas of investigation (e.g. idea generation approaches, relative effectiveness of different methods of application of the job plan).

MANAGING INNOVATION

Clearly, the role of a value manager is different from the roles of more traditional functional managers (e.g. finance, marketing, production). The central role of the value manager is the management of innovation. For the purpose of the present paper and to be sufficiently general to apply to a wide range of studies, innovation will be considered "the development and implementation of new ideas by people who over time engage in transactions with others within an institutional context"[2] Each of the key factors in this definition — ideas, people, transactions and context over time are commonly discussed by people in the value arena; and practice of most value managers has been based on their beliefs about these topics. Issues associated with effective innovative practice include the problems of managing attention to ideas, transforming the ideas into useful institutional currency, and the strategic leadership problems associated with institutionalizing the new approaches.

Managing Attention. People and the organizations they comprise generally focus on maintaining and supporting existing practices, rather than developing new ones. The most successful organizations are frequently ones who attend most to present practice — they have developed effective strategies and approaches and have had those practices effectively reinforced by success in the marketplace. Thus, in some highly successful organizations, it is very difficult to get people to focus on new ideas and opportunities. I have often heard members of SAVE state their belief that "Companies have got to be hurting before they will really look seriously at VE" or explain a company's non-use of VE as due to the fact that "They just weren't hungry enough". We know, of course,

that innovation and entrepreneurship are essential for social and economic development. Thus, one of the biggest problems is to manage peoples' perceptions of the utility of innovative approaches and the necessary context in which they can develop.

To manage individual and organizational attention, we must appreciate the physiological limitations that humans have when trying to pay attention to novel issues and the related inertial forces in organizations. Often in the literature, descriptions of innovators are similar to those of superman, with superhuman creative powers to create new ideas with a single bound. The reality is rarely like that picture.

Humans' lack of ability to deal with complexity and novelty has been well established. With a wide range of individual differences, the average span of attention is extremely short. Most people can retain raw data for only a few seconds in short term memory. Use of long term memory functions is like relying on "old friends" — linking the raw data with preexisting schemata and approaches previously encoded into long-term storage. Thus, we are very efficient processors in routine task situations. Once mastered, we do not even have to concentrate on repetitive tasks for which we have developed habits. Ironically, what we do the most is what we think about the least.

When confronted with a complex, novel problem, we frequently use primitive stereotypes as a defense to the anxiety such problems elicit. The more complex the decision characteristics are, the more conservative people become; increasingly depending on early learned approaches that have the greatest habit strength but possibly the least relevance to contemporary reality. Further, since the correctness of innovative ideas can rarely be judged with the level of precision we generally aspire to, the perceived legitimacy of the information-gathering and/or decision-making becomes the key criterion. Thus, as Janis points out, "as decision complexity increases, solutions become increasingly error prone, means become more important than ends, and rationalization replaces rationality".[3]

Perceived need for a change is a necessary precondition for stimulating action to determine improvements. When people perceive that existing conditions are unacceptable, their search for more satisfactory results will generally continue only until an acceptable outcome is found. This "satisficing" approach generally leads to most efficient outcomes and has been associated with success across time. Unfortunately, what people define as "satisfactory" is a function of aspiration levels the individuals have developed from their own experience. This "threshold model" for change initiation provides another concern for people in value work. People are limited in their ability to perceive change. "Just noticeable difference" (JND) is a unit of measure used by behavioral scientists to identify the amount of difference (change) that is required before a person can "see" that things have changed. Until at least one JND in the acceptability of present conditions is perceived, people will not be stimulated to initiate efforts to resolve their dissatisfaction. When exposed to stimuli that deteriorate very slowly, people do not perceive the changes and unconsciously adapt to the deteriorating conditions. Since the changes are gradual, the unit of change on a day to day basis does not reach one JND. Not until the problems have become extremely large, even catastrophic, will people reach the action threshold. At that point, innovative ideas become crisis management ideas developed in an atmosphere of high anxiety, defensive behavior and negative views of near-term success. Rather than the type of outcome we call "innovation" (i.e. useful new ideas), such crisis decision-making frequently results in "mistakes" (i.e. new ideas that are not very useful).

At the group and organizational level, problems of conformity, inertia, desire to protect sunk costs, and fragmented bureaucratic structures with inadequate interaction and incompatible preferences among specializations add to the individual physiological limitations of attending to information. In the classic study conducted by Pelz and Andrews, a heterogeneous group of interdisciplinary scientists became very homogeneous in approach and perspective after working together for as little as two years.[4] This phenomenon, often referred to as "groupthink", makes it especially difficult for groups to consider information that threatens the group values — the kind of information that is inherent in most innovative ideas.

Organizational structures and systems also manage attention. Programs and policies are developed to maintain the kinds of approaches or products that have proven track-records, to (hope fully) repeat the actions that led to success. Indeed the very systems that purport to support innovative thinking (e.g. strategic planning activity) often drive out strategic thinking as members are rewarded for following a "go through the numbers" activity of completing annual planning forms and cycles. The implication of this brief listing of personal and organizational limitations is that without the intervention of leadership, organizations and their members will attend to routine rather than innovative activities. At the same time, such systems tend to make members inattentive to shifts in environments and the need for innovation.

Clues to the management of attention. Management consultants frequently report that in their practice they generally focus on what management is NOT paying attention to. Suggestions to stay "close to the customer" have abounded across time in management literature. Especially well-run companies even search out and focus on their most demanding customers. Such face-to-face exposure increases the likelihood that members of the organization will be triggered to attend to changes in the environment or in customer needs. As necessary as direct personal confrontations may be, however, they also create stress.

Janis described five basic patterns of coping with stress.[5] Only one of the patterns, vigilance, was identified as generally leading to sound decisions. Vigilance involved an extended search, assimilation of adequate information, and a careful appraisal of alternatives before making a choice. According to Janis, vigilance tends to occur under conditions of moderate stress and when there is sufficient time and slack resources to make decisions.

When there is a lack of necessary resources, decision making resembles crisis approaches, frequently resulting in major implementation problems.

Argyris and Schon examined "single and double loop" decision-making models for managing attention.[6] Single loop learning represents conventional data analysis activity, basing actions to be taken upon the information derived from the monitoring system in place. As evaluation criteria are accepted as given, organizational inertia is increased.

In double loop learning, past practices are called into question. New assumptions are proposed, changes in basic strategies and approaches are considered appropriate, and the present state is considered open to modification. Such double-loop models lead to significant innovation. However, they also lead to anxiety, defensive behavior and low trust. Thus, as managers of innovation, Value engineers must be concerned with constructive attention management for effective idea generation. Further, innovation management requires effective strategic leadership for transforming the ideas generated into institutional currency and providing a culture of acceptance of new ideas. Most VE practitioners can support the validity of Hackman's observation that "an unsupportive organizational context can easily undermine the positive features of even a well-designed team".[7] Roberts (1984) described the special kind of leadership required for development of an "innovation-friendly" culture:

> This type of leadership offers a vision of what could be and gives a sense of purpose and meaning to those who would share that vision. It builds commitment, enthusiasm, and excitement. It creates a hope in the future and a belief that the world is knowable, understandable, and manageable. The collective energy that transforming leadership generates, empowers those who participate in the process. There is hope, there is optimism, there is energy.[8]

While the value manager is not responsible to set the overall cultural tone, attending to the characteristics above can provide for a more positive institution as well as more effective value programs. Each member of the organization can play an important role in key leadership functions associated with developing facilitative environments, including 1) defining mission, 2) embodying purpose into the organization's structure and systems, 3) defending the organization's integrity, and 4) ordering internal conflict. In many regards, value management activities are very closely aligned with these functions and can provide important evidence of the viability of the environments created.

Historically, the "pool of knowledge" was the dominant model of transfer of fundamental knowledge. This metaphor suggested that knowledge, like water, flowed under gravitational forces along contours of the socio-economic landscape where it inevitably lead to

growth and development. Knowledge was developed in universities and subsequently diffused to other sectors of society, including industry. It is clear that such natural gravitational forces are not sufficient for meeting society's need to receive innovative ideas in a most timely manner. Many people point to the "separate communities" of scholars and practitioners with very different language and values as the major impediment to diffusion and utilization. The reality of such a cultural difference gap has been debated. Nonetheless, the gap seems to be largest when researchers are academics, perhaps even widening because of the current emphasis in academia on rigor and abstraction. In the past, concerns about dissemination of information developed were generally limited to members of the research community. More recently, it has become evident that legislators and policymakers are cognizant of the need to make the outcomes of scientific endeavor available to target audiences. In 1989, P.L. 101-239 was enacted. This law focused on the understanding, efficacy, and effectiveness of dissemination as it required timely dissemination of health care research findings in as broad a way as possible.

This growing concern about dissemination is not without problems. There are significant gaps in our information about the dissemination process. Insufficient knowledge regarding the diffusion/utilization processes can lead to the development of programs and policies that are badly flawed, impossible to carry out, or result in useless information.

Part of this problem is due to the lack of common terminology and the use of various terms within multiple disciplines which make it difficult for developers and users to identify extant work. Development of a comprehensive thesaurus is critical if dissemination attempts will be able to use the relevant work of neighboring, but segregated, disciplines. Value for diverse groups with differing perspectives is a necessary part of the solution. While helpful for increasing shared meanings within SAVE, the development of the VE glossary of terms is simply a first step.

Other problems are due to the unfulfilled need for a data base that includes linkages with other disciplines and fields. Authors, as individuals, have a unique perspective on the field and on the knowledge that has been developed. Additionally, there are few incentives to synthesize the valuable findings of research from marketing, psychology, economics and other related literature.

Little information is available regarding the relative worth of extant means of information diffusion. Alternative approaches presently used include mass media, video, electronic access, professional development activities (e.g. conferences, workshops, continuing education), and interaction with colleagues. We need to investigate such issues as the relative efficacy of such means, the relative cost-effectiveness of one alternative over another, the mediating effects of user differences in sophistication, etc.

Perhaps most important, we have very little evidence about the changes (if any) that are produced in users' behavior once the information is absorbed. We all know that there is frequently a significant difference between what one knows and what one does. Careful studies of the motives and perceptions associated with use and non-use of value information could be vital to improving application of our techniques.

THE ROLE OF THE INFORMATION PRODUCER IN DISSEMINATION

In an important article synthesizing findings regarding the use of organization research, Beyer and Harrison recall a story about two faculty members:

A sociologist we know at Cornell was sometimes joined by one of his neighbors as he walked to the campus each morning. The neighbor, as a chemistry professor, often expressed skepticism about social science research. One morning he disconcerted the sociologist by greeting him with the question: "Have you seen your phenomenon lately?"

Few writers on dissemination could answer that question in the affirmative as so little of the writing on this topic has been based on systematic observation of the phenomenon. Merely thinking about dissemination doesn't take us very far.

The authors identified three different sets of behaviors involved in the processing of research information by users: "Sensing" occurs when potential users become aware of information, "search" occurs when potential users actively seek out information derived from research, and "diffusion" occurs then information is broadcast and spread through the user system. Four issues were viewed as central to those behaviors: the nature of the linkage between researchers and users, the activities of persons in linking roles, the timing of the research relative to events in the user systems, and the ease with which the users understand the research results. After reviewing numerous successful and less than successful programs of dissemination, Beyer and Harrison advanced a number of recommendations for improved effectiveness. A number of their suggestions have special relevance to VE programs.

First, "if researchers want their research to be used, they should act as their own self-advocates and disseminate their research findings in magazines read by users as well as in professional journals. They should devote continuous efforts toward consulting and executive training with levels of management appropriate to the variables they study. Also, researchers should pay more attention to diffusing research to future potential users through textbooks and their own teaching activities."[10]

While there there are dramatic examples of SAVE members who follow this recommendation, one of the reasons that these examples are so dramatic is that they are different from the norm. Everyone should be broadcasting VE information. In many ways, VE is a "best kept secret". Newspaper articles about the approach have been written, and rare articles published in mass media business and industry periodicals. All too often, however, the more common approach is one of "preaching to the choir". Every member must take seriously their responsibility to "make a joyful noise unto the world!"

Beyer & Harrison also suggest that qualitative as well as quantitative methods be used. Interpretations of quantitative results should be provided in a manner that is more comprehensible, relevant, and convincing to themselves and to users.

Concerning the information producer's role with regard to the basic data from which the principles or theories will be developed, the authors suggest that "researchers should immerse themselves in their phenomena. The shouldn't delegate or farm out all of the data collection, but should do a substantial portion of it themselves. In general, they should cultivate and use opportunities to observe people behaving in organizations."[11]

Unfortunately, some VE managers act simply as administrators of VE Change Proposals and budget. They don't get out into the organization to find out what potential issues should be addressed. They don't tie the VE operation into the business plan or work to motivate potentially effective and knowledgeable team members.

Beyer and Harrison also recognize the importance of "linking agents" — people who are able to translate the scientific results into practical applications; who are knowledgeable about the content and have the necessary human relations and communications skills to interact effectively with users. It is becoming increasingly difficult to staff such "linking roles" since resources to support training and research in applied social science have been decreasing, and many university faculty and students consider applied work low status. Information creators whose work is known by upper management have probably been active in diffusing their own ideas and in the process, they have probably indoctrinated some persons in linking-roles who are thus likely to diffuse the information further. Larry Miles' career included such activity, and it seems clear that present and future VE managers will have to view the "public relations and communication" components within their role as of high priority.

Even in studies that have been commissioned, it is extremely difficult to keep the research process in sync with the often unpredictable needs of users. Events frequently do not wait for results, as evidenced by the fact that the Louisiana Purchase was completed before the Lewis and Clark expedition was finished or its findings made available. Many design, product development, and strategic planning studies are extremely time-sensitive. It is important that the various phases of the job plan not become attenuated due to inappropriate time frames.

MODELS OF DISSEMINATION

As described by Rogers (1989), the agricultural extension model is a "set of assumptions, principles, and organizational structures for diffusing the results of agricultural research to farm audiences in the United States"[12]. Key to this model is the special

role of the extension specialist — linking the sources of research or evaluation based knowledge to county agents. In effect, the specialist is the county agents' extension agent. To perform this role, the specialist must bridge the scientific/intellectual world with the pragmatic world of the farmer. If the specialist is not able to meet the clients' needs — that is, if he cannot relate his or her technical knowledge to farmers' problems, the specialist's career is short lived. The reward structure clearly supports such activity. Performance appraisals include information regarding the number of times the specialists are asked to make presentations by county agents, the number of requests for bulletins authored by the specialist, etc.. A similar reward system is also in place for the knowledge creators (e.g. researchers, program developers) who are strongly encouraged to produce useful knowledge and to publish it in a form that can be easily assimilated by the users. Thus, all the members of the research/transfer process are pulling in the same direction to get useful information out and adopted by the clients. The most important characteristics of the extension model as Rogers views them include:

1. a critical mass of new technology, so that there is potentially useful content to be diffused;
2. a research subsystem oriented to utilization, resulting from personal ideologies, the reward system, and other policies;
3. a high degree of client contact;
4. a high degree of user control over the technology transfer process — evidenced by strong local control over the professional change agent by an organization of the clientele's leaders, called a county extension advisory council;
5. structural linkages among the technology transfer system's components — evidenced by use of a common language and shared sense of mission;
6. a spanable distance across each interface between components in the system — as demonstrated by the development of the role of extension specialist when the gap between researchers and users became too great in terms of formal education and technical expertise;
7. evolution as a complete system, instead of simply "grafting" the diffusion and implementation aspects onto a program focused on research;
8. a high degree of control of the technology transfer system over its environmen — so that the system can operate proactively and obtain necessary resources rather than simply react to already extant changes. [13]

Many of these characteristics can be identified in present VE practice, but more often we can find one or more attributes missing. We need increased development of the technology, organizational policies and systems that are more supportive of innovative team performance, stronger relationships with potential customers and other members involved in the studies, and a greater sense of our mission as including each of the elements of knowledge production and application. Value managers must effectively span boundaries throughout the process.

Linking relationships can be extra-organizational as well. Newell and Clark suggested that the "process of technological innovation does not occur exclusively within an organization's boundaries; it is grounded and contexturalized by its links with external networks, pressures and forces. Thus the extent to which networks are developed through which industries can learn about and appropriate new best-practice information is central to the survival of the industry.[14]

"Boundary spanners" who are responsible for the accommodation of up-to-date information must have considerable influence within their own organizations to disseminate the information obtained. The number and effectiveness of individuals holding positions in extra-organizational professional/technical networks is strongly associated with an organization's ability to identify needs for change and strategies necessary to implement such change.

Professional associations such as SAVE should play an important role in the dissemination of information and thus act as field agents in Roger's agricultural extension model performing the important role of first-step information supplier.

In their cross-cultural study of such external network effects, Newell and Clark provided compelling data regarding the importance of such linkages.[15] In part, this study examined the role of the British Production and Inventory Control Society (BPICS) in the development of innovation and compared that role with that of the American Production and Inventory Control Society (APICS). Both groups used very similar knowledge diffusion channels including bi-monthly newsletters, quarterly journal, specialized publication, diploma program, practitioner training modules, annual conferences, seminars, and local chapter meetings. However, the results suggested that unlike the more direct link that APICS has to practitioners in the production planning and control area, the role of BPICS was mediated by consultants. While over half of the BPICS members surveyed responded that there was actually too much information provided, most members also indicated that they read such information only one or two hours per week. Members who were in the supply side, consultants, reported significantly greater amounts of reading and involvement in Society activities. The authors also indicated that of the BPICS membership, "most of the highly qualified people are more likely to engage in consulting rather than actually operate in industry."[16]

While provision of the information necessary for innovation by external sources may reduce the need for costly internal techno-structures (as found more commonly in the U.S.); without the necessary "boundary spanners" operating within the organization, the information flow required for innovativeness may be lacking. This is a concern that may be equally relevant to SAVE. As the proportion of organizations that are involved in VE activity through use of external consultants rather than internal capability seems to be increasing, the role of the consultants themselves in the knowledge process becomes more urgent and more extensive.

DISSEMINATION ISN'T ENOUGH

Although we clearly need to increase the diffusion of VE knowledge, there are cases in which this is not the relevant part of the process to be considered. The rationale for dissemination can also be reversed; rather than not enough information, policy and decision-makers can be seen as having too much. Dissemination should become a tool to free these people from the burden of an overwhelming influx of studies, fact, and figures. This "overload" problem requires that disseminators must simplify, clarify, and pass through only relevant knowledge within the decision-makers field of view. Disseminators must also be translators, interpreters and gatekeepers.

KNOWLEDGE UTILIZATION

The study of knowledge utilization is limited by lack of clear indicators of when "use" has occurred. Operational definitions include (from the least to most demanding) simple reception of the information, understanding the knowledge received, including the information in one's frame of reference, demonstration of effort to incorporate the knowledge at the program or process level, actual policy adoption, visible implementation in practice, and evidence of positive impact. While most would agree that simply "receiving" the material is not sufficient evidence of use, demonstrated impact maybe an unduly severe standard.

In VE, utilization often has to do with a long-term process in which the accumulated results of practice enlighten policy. Eventually the information becomes accommodated as background for policy-makers and does influence decisions.

As suggested earlier, the lack of utilization may not be due to lack of knowledge itself, nor ignorance of extant knowledge. Rather, the decision-makers could simply find the information disseminated to be inadequate.

When the knowledge received by decision-makers is not viewed as compelling, it could be because the information was provided to the wrong person within the organization. Possibly a "pre-packaged" approach to disseminating information was used, leaving out crucial local elements. Perhaps the perceived integrity of the information source was questionable.

There is evidence of frequent "premature dissemination" (of incomplete or untested notions) which creates cynicism. Before it can be adopted then, a really worthwhile innovation may first have to overcome the cynicism generated by earlier, less appropriate, dissemination efforts. We should never spend efforts on dissemination when the real problem is lack of knowledge. When knowledge is scarce, we should reallocate expenditures away from dissemination and toward development of the discipline.

It is even conceivable that the content being disseminated is actually not useful. Even if a given strategy like VE is adopted, there is no guarantee that it will be carried out correctly. Some have

argued that once certified, Value Engineers can be trusted to implement the technique properly and that what really counts is outcome data such as cost-savings or market share increase. While such indicators of "improved value" should be taken seriously, they are not sufficient. Even if there are dramatic improvements, it is necessary to understand why. Implementation studies are needed to shed light on the specific elements that are associated with effective practice, and then those elements must be incorporated into VE training and certification efforts. Construct validation of our certification process should be undertaken to assure that the "knowledge producers" can actually produce knowledge.

ArtificialDissemination. Even if no major impediments (above) to utilization exist, there are still times when the "natural" process of dissemination is not sufficient. Natural dissemination may fail due to inattention, personal resistance to change, geographic isolation or poverty. In such cases, what types of linkage strategies might be substituted?

First, we can consider moving information to match the needs of decision-makers with a supply of relevant knowledge. "Passive" information movement requires a request from the user to initiate the transfer, such as in computerized retrieval systems. With this approach, constraints of time and money in developing the system are significant; and in cases of inattention and resistance, the effort will be useless. In "active" information exchanges, the disseminator initiates the search for and transmission of information. Here the costs to the user are greatly reduced, but costs to the disseminator are certainly non-trivial. Indeed, some SAVE members and chapters have successfully initiated active artificial dissemination. "Pro bono" studies have been conducted as demonstration studies or for organizations without sufficient resources (e.g. small villages, schools). Presentations have been made to future potential users in university classes. Graduate students have been sought and supported to work in this area. These are all good efforts, but they must be increased significantly to meet the extent of the need.

We can "move people". Such actions as temporarily assigning people to the organization that needs the capability, providing "staff on loan", or bringing members from the outside group into the resource organization are clearly the most expensive approaches to dissemination when natural processes fail. However, we should at least consider the feasibility of such ad hoc placements as these approaches have proven highly effective in other fields. A little lubrication of active exchanges helps prime the pump of natural dissemination, achieving a multiplier effect for each dollar spent.

EPILOGUE

This paper is an attempt to develop a conceptual framework to guide learning regarding ways to improve the knowledge process in VE. It is a speculative essay on issues associated with innovation management. Little empirical evidence is now available to substantiate the suggested relationships. This situation cannot be allowed to continue. Systematic evidence that will improve our understanding of the central problems of innovation in VE must be collected. Most people tend to think of themselves as working, or at least concentrating, on only one single element of the overall knowledge process — on knowledge creation or knowledge disseminating or knowledge utilization. As a result, these component parts have developed rather independently from one another and do not provide an integrated whole. It is time to work on getting the pieces together. Value managers must perform two very different roles — "value-theorist" and "value-practitioner." The requirements of these roles are both very real and important. They are, however, also very different. The differences in characteristics revolve about the issues of caution versus confidence.

When interacting with team members or potential users, or in training in value techniques, the value- practitioner role is appropriate and requires obvious enthusiasm and commitment to the ideas presented. If a value manager conveys the impression to team members that he is not convinced that the activity will be successful or worthwhile, the others are likely to respond accordingly. If he acts enthusiastic and communicates the attitude that he really believes in the effectiveness of what he is doing, that attitude may also be contagious.

At other times, we must assume the role of value-theorist, reflecting in a skeptical way on our activities and the principles underlying them. As value-theorists, we should be asking questions such as "How should the job plan be modified, in nature or implementation, to fit the requirements of this particular problem?" or "Am I delivering this information in a manner that it will be transferred to other problems?". Finally we should all be examining ways to improve not only our practice as a utilization issue, but also ways to improve the production and dissemination of our knowledge. These are necessary prerequisites for future growth and development of VE as a field.

> To him who devotes his life to science, nothing can give more happiness than increasing the number of discoveries. But his cup of joy is full when the results of his studies immediately find practical application. There are not two sciences. There is only one science and the application of science, and these two activities are linked as the fruit is to the tree.
>
> Louis Pasteur[17]

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