RESEARCH ON THE UTILIZATION OF KNOWLEDGE

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Let me begin with a rather distressing finding that turned up recently in one of our projects. Two of my colleagues have for the last three years been engaged in an intensive investigation of R&D management and research utilization in a large federal agency (Lingwood and Morris, 1973). This agency has jurisdiction over an important part of our natural environment. All the top staff in the various labs of that system who were interviewed stress that the prime mission of the agency is application, applying science to improving our methods of coping with soil conservation, pest control, and so forth. Yet my friends find that the greatest actual rewards in this system tend to go to those with an orientation to basic knowledge building, not to applications. In other words the concern expressed at the top is essentially lip service to utilization. The real rewards are all in the other direction. This is not an isolated story. The fact is that the scientific community doesn't care very much about utilization, or if they do, they have a funny way of expressing their concern. Therefore, I am very pleased that the organizer of this symposium has seen fit to include one segment addressed to research on knowledge utilization. This topic has been my preoccupation most of my professional life and exclusively for the last eight years, but I think it is also a topic which is very important, if not central to the wisdom of WISE. The thrust of my argument will be simple, to wit:

First, we do not know how adequate our existing processes for knowledge utilization are.

Second, we can find out by systematic study of these processes.

Third, we have done very little of this to date but what we have done may form a basis and certainly suggests that such systematic study is possible.

and Fourth, we can use well-designed research on utilization as a vital input to the evolution and self-steerage of WISE, itself.
Let me begin with a few very rudimentary distinctions. I think our discourse here concerns three somewhat distinct processes which I will call "generation," "dissemination," and "utilization." Each of these words describes a different aspect of the total enterprise of science, and together they suggest a sequence of activities which may in some cases lead to the solution of the important problems which have confronted mankind through the ages.

First, the "generation" of scientific knowledge deserves the least comment in this context. I am referring to how the methods of science are intermingled with the genius of individual scientists to produce new facts, theories, or methods, adding in some incremental fashion to what we collectively know about ourselves and our universe.

"Dissemination," in contrast, refers not to how things are created but to how they are moved from one place to another, from one person to another, or from one group to another. "Dissemination" presupposes that knowledge already exists and that its essential elements can be transmitted from point A to point B without distortion or transformation.

Finally, "utilization" refers to what happens when knowledge arrives at its destination. It speaks to the question of how knowledge is received, transformed, and consumed once it has arrived at point B.

In considering WISE we are, no doubt, concerned with all three processes but I think we are most centrally concerned with the second, "dissemination"; at least this must be true if we subsume within WISE the notions of collection, storage, and retrieval; however, I will submit to you that we cannot design properly or rationally for WISE without also considering the third process, "utilization." In short, we must know how and why people acquire knowledge and why they make the effort to attend to the knowledge they acquire.

*World Information Synthesis and Encyclopedia.
As I describe for you what I think knowledge utilization is all about and how we can study it, I hope you will be keeping one question in front of you. This is the question: how important is the maximum use of existing scientific knowledge? In asking yourself this question, you will also need to consider two subsidiary questions. First, what do we mean by "maximum use?" and, second, "use by whom?" To my way of thinking "maximum use" consists of what I will call "full entry into the problem-solving space of all potentially relevant users," but more on this later. Regarding "use by whom," I suspect that at most meetings such as this one, the primary concern is the communication of knowledge from scientist to scientist, and indeed, this is the least complicated way to look at the problem. Most studies seem to suggest that research utilization is least problematic between one researcher and another working in the same specialty, and the narrower the specialty the better; the language is the same; the problems are the same or closely parallel; the methods by which the knowledge has been generated are thoroughly understood by the receiver. Hence, there is no need for elaborate transformations or interpretations; there is no need for special agents to act as intermediaries; there is no need for any complicated delivery schemes or strategies. But obviously not all users belong to such a charmed circle. Indeed as we move from hard science to soft (social) science, as we move from basic science to applied science, as we move from narrower specialty to broad disciplines to interdisciplines, and as we move from research to practice the problems of communication escalate. Surely, we are concerned about effective communication across these more difficult interfaces. Indeed, it is my argument that if we can understand how knowledge is transferred from research to practice, we will have unlocked one of the doors to human progress.
This brings me back to the first question, how important is this process of knowledge transfer? Obviously, I think it is very important but I ask the question because our society has acted and is continuing to act as if it is not important at all. For every dollar we spend on generating scientific knowledge, we may spend one penny on dissemination and utilization combined, and for every dollar we spend studying science, we spend less than a penny studying how scientific knowledge is disseminated and utilized. To those of us who think the transfer process is so vital, this is a very confusing and frustrating situation.

There is a sensible argument on the other side of this question. I think the argument runs somewhat as follows. First of all, it can be said that there is a system of communication within science and between science and practice. This existing system has been with us since the beginning and has been evolving in what some might call a "natural" way as science has grown; communication, has after all, been at the heart of science from the early letter writing exchanges that eventually became the Royal Society. Today, the visible core of this system is the journal, but the real system is far more elaborate than that; as Crane has noted, each specialty tends to form its own invisible college within which formal and informal exchange goes on by mail, phone, and meeting; each invisible college also has a distinct social hierarchy which preserves the status quo but also fosters very high speed and accurate interchange among all members.

Thus, there are some data which suggest that what we have is a "system" OK within certain limits. It is not so OK where we have longer distances between the world of the generator and the world of the user, e.g., between basic and applied, between research and practice, between discipline A and discipline B. Even here, however, it could be argued that the social and technical barriers to communication are not only natural but
beneficial, that they serve as a filtering process. New ideas generated by scientists begin in a very tentative fashion as hypotheses. Then they are tested and replicated over and over again before any sense of certainty is attributed to them. Therefore, the argument goes, new ideas should not be speeded across the social barriers of scientific communities until this verification process is near complete. Least of all should such ideas reach practical applications affecting people's lives until such validations are established.

I am inclined to reject this notion of the "natural filter" for one primary reason: we simply don't know enough about the filters, how they work, whether they work protectively and beneficially, and so forth. Our knowledge is lacking because we have not studied them nearly enough. Thus, it is equally arguable that we should strive for improvements, altering this system, breaking down some barriers, bolstering others. This is what I think a science of knowledge utilization should be working on.

My premise is that science, as a process, including generation, dissemination, and utilization, provides the most satisfactory method for solving human problems. This is an optimistic statement, I realize, and one which has been pooh-poohed in many quarters in the last five years, but I still affirm it; and if it is true, it should be possible to state with a great deal of precision just how it is that the science in various fields of knowledge is utilized in the solution of various human problems. Unfortunately, this is not possible. We have very little reliable knowledge about research utilization, and this for a very simple reason: we have done very little research on it.

My work in this area began just ten years ago. As far as I have been able to tell from reviewing literature and discussions with various people, there were then perhaps three or four people in the entire world who were committed to the study of research utilization as a full time endeavor. Today there are perhaps twenty of us, and there is some research on research utiliza-
tion beginning to accumulate but it is a very modest amount. Thus, it behooves us to recognize the miniscule investment which has been made in the systematic study of research utilization as a social-technical process in contrast to the size and dimensions of the problem and its overwhelming social importance.

In spite of these limitations, a little progress has been made in at least two directions which are very important, one conceptual and theoretical, the other empirical. Let me start with the conceptual side. Simply to recognize that research utilization is a process which can be studied is progress, but we have gone beyond this to define the parameters in some detail, to show the connections to related concepts in psychology, sociology and communication science. Conceptual frameworks are very important and useful not only to generate hypotheses and to guide research efforts but also to give practitioners and policy makers some clarity and some tentative guidance.

A. THE EMERGENCE OF THEORIES OF KNOWLEDGE UTILIZATION

Figure 1 depicts the essentials of the paradigm we have come to use to describe the elements in a research utilization process. It builds on two ideas: first that user communities and research communities are separate problem-solving systems and, second, that two-way communication between them is the essential prelude to the event we call 'research utilization.'

FIGURE 1
The Problem-Solving Dialogue

\[ \text{Communication of Needs} \]
The figure suggests an underlying proposition that societal problem-solving comes about through the formation of relationships between user systems and resource systems. These user-resource linkages contain four essential sub-processes, namely (1) the articulation and transmission of user needs, (2) the generation and development of new knowledge, skills, and products, (3) the transfer of new knowledge, skills, or products from resource systems to user systems ("diffusion"), and (4) the utilization of new inputs by user systems in local innovating and problem-solving efforts. The arrow at the bottom of the figure, labelled "communication of needs," is meant to indicate that the research and development that is done must be relevant and responsive to the real needs of our society. The "diffusion" arrow at the top of the figure indicates that the useful results of R&D must be effectively communicated to users, and the utilization semi-circle is standard to suggest that communication is not enough: the user needs help on implementation and integration of useful research knowledge within his system.

This problem-solving dialogue occurs at many levels in the social structure and applies generally to interorganizational as well as to interpersonal relations, regardless of the specific content or knowledge being utilized, and regardless of the size and internal complexity of the systems to which we are referring.

Figure 2 shows a number of persons in different roles in different organizations. We can imagine that persons more to the left of the figure see themselves primarily as knowledge producers, researchers, developers, scholars, and specialists of various sorts. The people more to the right are more concerned with using knowledge in practical ways to benefit themselves or others, to teach better, to learn better, to live better. In a
society as complex as ours there is a tremendous spectrum of resource and user roles which ultimately have to be connected to bring about knowledge transfer from research to use. But this knowledge flow chain is made up of many individual links between persons, groups, or organizations; each pair needs to enter into a kind of problem-solving dialogue before successful knowledge transfer can take place.

The model outlined in Figure 1 has been elaborated and used rather successfully to describe the workings of a number of complex D&U systems (Havelock and Lingwood, 1973; Lingwood and Morris, 1973). It can also serve as a set of reference points in discussing much of the past literature relevant to research utilization.

I do not pretend, of course, that everybody will be happy with this one picture of a very complex process. In fact, there appear to be some distinctly divergent schools of thought regarding this subject. Because I think we are all blind men examining different parts of the same elephant, I am going to refer to these schools of thought as "perspectives." My analysis derives from a rather exhaustive search of the semi-relevant literature undertaken.
in 1967 and 1968 (Havelock, et al., 1969). After quite a bit of mental struggle with all this material, there seemed to emerge three distinct viewpoints. In very brief outline, they were as follows:

RD&D Perspective

One perspective was clearly sender-oriented and message-centered; it stressed how sound, reliable, useful knowledge is created, transformed, packaged for export, and sent out. We called this the "RD&D" perspective. It represented a very orderly, systematic, logical systems approach to change which has been popular in Washington since Mr. McNamara came to town, if not before.

Problem Solver Perspective

A second perspective was very much user-centered, very nearly excluding consideration of outside expertise as a force in bringing about change. It took its lead from the non-directive psychotherapy model of Carl Rogers and the human relations trainers. It was a psychological and humanistic view which put highest value on the self-perceived needs and circumstances of client systems. The primary legitimate intervention by outsiders would be to provide assistance on the process of change, particularly on ways to develop group solidarity around goals and needs. Hence, we called this school the "problem solvers."

The Social Interaction Perspective

A third view was much more empirical and non-committal, represented most strongly by sociologists conducting research on the communication and diffusion of innovations. These investigators took the position of observers of a passing scene rather than advocates. They were scientists measuring the flow of knowledge as a social phenomenon, counting the number of adopters
at time-one, time-two and so forth. We choose to call this school the "social interaction" perspective for two reasons: first, their primary focus was on the communication and transfer between people and between organizations, rather than on what went on inside them; and second, their major empirical findings tend to show the overwhelming importance of interpersonal social interaction, particularly at an informal level, in bringing about successful transfer.

A similar typology of perspectives has also been derived by Archibald (1968) from a thorough review of literature on policy analysis and applied social science, supported by 34 interviews and a number of observations related to research utilization in the area of arms control, disarmament, and defense policies. Her corresponding categories are "academic orientation" (roughly comparable to what we called the "social interaction perspective"), "clinical orientation" (very close to what we call the "problem solver perspective") and the "strategic orientation" similar in some respects to what we called "RD&D." In her brilliant exposition, Archibald shows how each orientation colors the change strategies of its advocates and leads to many of the problems, gaps, and conflicts that make research utilization a difficult social process, even in areas of vital national and world priority.

We have found the same kinds of ideological divisions emerging in other studies, and we have used factor analysis to derive the attitudinal dimensions more empirically and using samples of practitioners, researchers, and government program administrators as respondents. (Havelock and Havelock, 1973; Havelock and Lingwood, 1973.) Very clear user-centered (or problem-solver) and RD&D-centered attitude clusters emerge from these analyses, with much less clear clusters related to the academic-social interactionist view.
LINKAGE AS A UNIFYING CONCEPT

Our longer-run objective in pursuing these studies of competing ideology is to find ways in which they can be synthesized; it is my personal view that a truly satisfactory theory and process of research utilization emerges only out of a fusion of perspectives. It was this belief that prompted us to derive the "linkage" model with which we began this discussion. It is essential to think of the R&D community and the related practitioner community in any social or technical problem area not as separate systems but as interdependent sub-systems within a larger problem-solving process, as suggested in Figure 3.

The concept of linkage starts with a focus on the user as a problem-solver. We must first consider the internal problem-solving cycle within the user. The user experiences an initial "felt need" which leads him to make a "diagnosis" and a "problem statement." He then works through "search" and "retrieval" phases to a "solution," and finally to the "application" of that solution. But the user must also be meaningfully related to outside resources.

[Insert Figure 3 here]

The user must make contact with the outside resource system and interact with it so that he will get back something relevant to help him with the solution process. The user must enter into a reciprocal relationship with the resource system that corresponds to what is happening in the user. In effect, resource systems and resource persons must simulate or recapitulate the need-reduction cycle of the user; they should be able to (1) simulate the user's need; (2) simulate the search activity that the user has gone through; and (3) simulate the solution-application procedure that the user has gone through or will go through. It is only in this way that the resource person can come to have a meaningful exchange with the user.
FIGURE 3

A Linkage View of Resource-User Problem-Solving
This reciprocity with the user includes testing the adequacy of the simulation model, itself. Only through an interaction and a feedback from the user can the resource person learn whether or not his model of user-behavior is correct. At the same time, the user should be learning and beginning to simulate resource system processes such as scientific evaluation and product development. Only through understanding, appreciating, and to some degree emulating such processes, will the user come to be a sophisticated consumer of R&D.

The development of reciprocating relationships goes beyond the point of improving individual problem-solving processes toward the creation of a stable and long-lasting social influence network. This collaboration will not only make a solution more effective, but, equally important, it will build a more effective relationship—a relationship of trust and a perception by the user that the resource is truly concerned, that the resource will listen and will have a quantity of useful information to pass on. The reciprocal and collaborative nature of this relationship further serves to legitimize the roles of consumer and resource person and it builds a channel from resource to user.

Linkage is not simply a two-person interaction process however; the resource person, in turn, must have access to more remote and more expert resources than himself, as indicated at the left hand side of Figure 3. In his efforts to help the user, the resource person must be able to draw on specialists, too. Therefore, he must have a way of communicating his need for knowledge (which, of course, is a counterpart of the user's need) to other resource persons and these, in turn, must have the capacity to recapitulate this same problem-solving cycle, at least to a degree. Only in this way will they be able to develop a functional relationship with each other.
Therefore, an effective change process requires linkage to more and more remote resource persons, and ultimately these overlapping linkages form an extended series which can be described as a "chain of knowledge utilization" connecting the most remote sources of expert knowledge in the university with the most remote consumers of knowledge.

It is possible to identify and differentiate within our total society a variety of knowledge-building, knowledge-disseminating, and knowledge-consuming subsystems, each with its own distinctive protective skin of values, beliefs, language, and normative behaviors. These could be referred to as the "research subsystem," the "development subsystem," the "practice subsystem," and the "user subsystem." At a gross level, the prime task of knowledge utilization is to bring these great subsystems into effective linkage with each other; the kind of reciprocal simulation and feedback relationship described above needs to be established at the interface between systems. Linkage between systems is the essential process in any effort at planned social change.

One other area where I think we might be making some progress is in what I call the micro-analysis of transfer phenomena. We have long been used to the communication formula of sender and receiver with a message flowing through some medium from the one to the other. In recent work with my mathematics colleague, Frank Harary (Harary and Havelock, 1972), we have derived a somewhat different formulation which we call sending and receiving demi-arcs. True transfer cannot take place unless a sending and receiving demi-arc are each poised to connect with the other, and it is no simple matter to bring this juxtaposition about. The formulation is important partly because it raises the status of the message receiver to co-equal and necessary partner to the sender. We also believe that through demi-arc theory we can demonstrate by deduction the necessity of two-way communication.
Complete knowledge transfer cannot take place unless sending and receiving apparatus are juxtaposed and synchronized. For complex messages this may require several rounds of meta-communication involving similarly coordinated demi-arcs.
between sender and receiver as a precursor to transfer of knowledge from the so-called "sender" to the so-called "receiver." Demi-arc analysis may also bring about a happy marriage between knowledge utilization theory and graph theory.

B. SOME RELEVANT EMPIRICAL STUDIES

From what I have said so far, I hope you can appreciate the fact that there is quite a bit of theory about and that some of it might be useful in building a science of knowledge utilization. But I also said we have made some progress on the empirical side as well. I cannot in this paper review for you all the work which has been done but let me discuss one area where I think we are seeing some light. This is the whole area of networks and the function of leaders or stars in networks. From a strictly empirical viewpoint, the strongest set of studies on which we were able to draw concerned the diffusion of innovations. There has been a tradition of empirical research in this area dating back to the 1930's, mostly coming from rural sociologists studying the adoption of new farm practices. We have been fortunate to have had a few scholars available who were able to pull together the strands of this research tradition not only from rural sociology but also from medical and educational sociology and from studies of socio-technical intervention and innovation in many developing countries. In 1962, Everett Rogers was able to cite over 500 studies in his integrative summary of diffusion research up to that time (Rogers, 1962). By the time of his second edition, published 9 years later, the number had more than doubled to 1200, with a large number stemming from work in developing countries (Rogers with Shoemaker, 1971).
These studies have told us much that is relevant to the study of research utilization. One fact stands out above all others from their work, that individual human beings are embedded in and inextricably connected to social networks which largely govern their behavior with respect to any technical or social change: the great majority of people in all societies seem to adopt new ideas and new products largely because certain key members in their group have already done so. Most of us follow the lead of others whom we respect, and this is probably just as true for adopting research findings as it is for adopting products.

Diffusion researchers have also found that the pattern of innovation spread in a social system is somewhat predictable, following the lines of informal networks and cliques from peripheral innovators to opinion leaders to in-group members closely associated with the opinion leaders; then very rapidly diffusion spread, like a fulminating plague, the great majority following.

When we try to interpret these findings in terms of research utilization, we are faced with some difficulties. "Research" and "innovation" are not the same thing. Usually an innovation to be studied needs to be in the form of a product or a clearly definable service or practice. It also has to be stable in form so that it is the same thing at Time-Two as it was at Time-One and the same thing in the hands of the receiver as it was in the hands of the sender. None of these things can quite be so true for research as such. Research findings may suggest stopping old habits (like smoking cigarettes) as much as adopting new ones; they are generally not transmitted in product form and they are almost always transformed by sender and receiver, particularly if
genuine utilization is to be the outcome. These points do not invalidate the diffusion research findings, but they temper them a little, and we need to know more. It is especially important, for example, to find out how scientific knowledge about innovation affects adoption rates. We do know, for example, from a study by Morgan, et al. (1966), that the reported use of auto seat belts was positively related to both formal education and to a generally receptive attitude toward modern science. It is also reported (Tichenor, 1971) that public use of science content in the media is highly correlated with socio-economic status. Perhaps we can draw an inference here that science does have an impact filtered through social elites. If these elites are also the pacesetters for innovation, then there is some hope that the blind adopters further down the line will not be led too far astray.

A second set of findings with some importance to research utilization comes from the study of scientific communication which was really just getting going in the very early 1960's but which now has accumulated quite a backlog of consistent findings. Landmark studies in this area were conducted by William D. Garvey and his associates, first at the American Psychological Association, and then at Johns Hopkins. The APA study was a rather thorough series of empirical investigations which mapped out both the formal and informal channels by which research knowledge in psychology was communicated from one person to another. They found that communication in psychology took place within a rather efficient and well organized closed system. Generally, scientists talked to scientists with information dribbling out

to the practitioners and to the general public only when it was thoroughly digested and rather old. They noted that both formal and informal communication channels served important and complementary system functions. Formal channels reach a larger audience but are less current than informal ones.

The role of informal channels is further explored by Diana Crane (1972) through studies of what are called "invisible colleges" within the scientific community. It turns out that most scientific disciplines are organized into tight little social islands of specialists who exchange information on their on-going work, and who cite each other in their published work over and over again. The clusters tend to be led by a few stars, usually located at prestigious universities, who in many newer areas are also the pioneers of the field. The network becomes a network not because all members are connected to each other but because almost all members are connected directly to stars.

In general, the more established the scientific discipline, the more effective are its modes of internal communication, both formal and informal. Unfortunately, however, there have been few studies which have traced the flow of communication at the fringes of a discipline, particularly where it overlaps with a related area which is more applied or practice- and product-oriented. The few available studies relevant to this matter suggest that there may be formidable barriers at these interfaces partly attributable to the very internal strength of the invisible colleges, themselves, and partly attributable to the lack of motivation to transform, interpret, and simplify the knowledge communicated for the benefit of users on the periphery. Mackie and Christenson (1967) found this to be the case when they tried to find out why millions spent on learning research by the Navy had such little effect on changing Navy training programs and other potential applications. They concluded that learning researchers,
while maintaining a very tightly integrated internal communication system, did little and cared little about translating and integrating their work with an eye to applications by the Navy or anyone else.

Diffusion and communication research studies over the years have accumulated quite a bit of evidence on the existence of the phenomenon known as the "opinion leader." Most of us, it seems, are influenced to change by observing the behavior and following the advocacy of certain people in our own social circle whom we admire and respect. This is not a startling finding, perhaps, but it is somewhat surprising in its total pervasiveness to all sectors of communication including research utilization. The fact that there are stars in communication networks who tie the networks together and set the norms for others is well established by studies such as those on scientific communication cited earlier. A more relevant finding for us here is the fact that some stars also perform a vital bridging function not only between disciplines but between research and application. For example, in a series of studies of information flow in applied research and development laboratories Marquis and Allen (1966) and their co-workers at MIT have found that most engineers and development-oriented specialists rely very little on direct reading or other communication with the relevant adjoining scientific disciplines, but there are almost always one or two individuals in an applied laboratory who are in very good touch with such external sources and who are relied on by their colleagues for such knowledge. Thus, they serve as gatekeepers for the flow of technical information from basic to applied science.

Indeed, opinion leaders in applied research areas may play an even more significant bridging function. In a study of the flow of research knowledge from highway safety researchers to national decision makers, Havelock and
Markowitz (1971) found that a small cluster of researchers, nominated most often by their colleagues as "doing the most important work", constituted a very distinct elite which performed many vital functions not only in tying sub-specialties together but also in bridging between disciplines, in leading the way towards new ideas, and in bridging between the research community and the national decision makers. The research opinion leader (ROL) profile which emerged is summarized as follows:

Among the characteristics associated with them were (a) higher education level, (b) older age, (c) more years in highway safety field, (d) more likely to be in a scientific rather than an engineering discipline, and (e) more likely to be employed by a university than by government or industry.

More importantly the ROL's seemed to be the most dedicated and committed individuals doing research on highway safety; they rated their work as "most relevant" more often, attended more conferences, read more, and participated more in safety organizations.

ROL's also seemed to be highly conscious of their own leadership position. They usually saw themselves at the center of activity in their specialties, and more than other researchers they see themselves as effective in reaching decision makers and influencing decisions; they are especially oriented toward national decision-making and are apparently more effective than their colleagues in influencing decisions in the federal government and in the auto industry.

ROL's also share similar views to one another on a large range of safety issues. They generally advocate "new guard" positions, taking a systems view, being sceptical of the efficacy of traditional countermeasures, and rejecting the "nut-behind-the-wheel" philosophy. At the same time, they seem to be better informed than their colleagues on new research outside their own fields.

All these findings taken together suggest to us that the ROL's are a cohesive, dynamic, and progressive force within the research community which forms a genuine bridge to the decision makers.

Terms like "opinion leader," or "gatekeeper" apply generally to roles in the social system which occur naturally. There have also been some studies of roles which have been created for the specific purpose of improving re-
search dissemination and utilization. The most venerable example of this phenomenon is the county agent who constitutes the personal link to the farm community in the Cooperative Extension Service. A number of diffusion studies have noted agent contact as an important stimulator or adoption, but there have been very few studies which give any whole view of what this role is all about (an exception is Stone, 1952). In the late 1960's the U.S. Office of Education decided to emulate the County Agent model on a modest trial basis as a human extension of the previously developed educational archive known as "ERIC" (Educational Resource Information Center). Each of three state education agencies was to have an information center which could search ERIC and reproduce written materials on any educational topic on demand. Attached to the center would be two or three field agents who would go out to visit schools in various parts of the state, help teachers and administrators to identify needs and problems, and then feed back to them whatever information they could find which was relevant. There was thus a clear intent to insert research information into a user-controlled problem-solving sequence. Although the pilot program involved only seven agents in three states, the federal authorities had enough wisdom to sponsor a thorough and detailed evaluation study which was both quantitative and at the same time rich in clinical descriptive detail. The two volume report thus forms a valuable guide to the planning of future programs of this kind and to the training of this type of change agent. The findings reported by Sieber, et al. (1972) and summarized later by Sieber (1973) indicate that research knowledge-based agents can be extremely effective not simply as conveyors of facts but as catalysts for a change process within the individual client and the school system of which the client is a member. Their impact as change agents was measurably greater than subject-matter specialists or other persons inside or outside the school
system. In the judgment of the clients, themselves, meticulously documented by the Sieber team, "the agent's contribution excelled that of all other individuals within the client's professional orbit." (Sieber, et al., p. 548) The authors suggest some reasons why this might be so: "the agent was not introduced to clients as an instrument of change, but as a conveyor and interpreter of available knowledge." Expertise is independent of the agent and hence, "(1) there is no status differential between client and agent owing to the latter's greater knowledge or higher organizational rank, and (2) the agent will not necessarily be held responsible for poor information." "The field agent also plays the part of a change-agent but only after his role as a conveyor of information has legitimized his presence and precluded suspicions of his pushing or imposing himself on clients." (Sieber, et al., 1972, pp. 538-541). As Sieber (1973, p. 95) sums it up "the Pilot State Program was a highly successful venture not because it operated smoothly and effectively from the beginning, but because of the way in which myriad problems were resolved so that a model emerged for future extension and retrieval programs." It also seems clear that this emerging knowledge linker model has relevance not just in education but in community development, social service, population planning and many other "need" areas.

C. NEEDED: R&D ON KNOWLEDGE UTILIZATION

So much for the theory that exists and a few empirical findings. I have offered only a sampling to indicate some of the areas we are pursuing. I would now like to conclude by saying where we should go from here. Basically two things are necessary if we think that optimum research utilization is important. First we need more research on it, and second we need to develop improved processes by applying the implications of that research to the existing mechanisms of information transfer.
First then, how should this research be undertaken? I have suggested one paradigm which lays out functions in an orderly manner (Figure 1). We might take this list or some other which represents more of a consensus on what the chief functions are and then prioritize the functions by judging how well each is performed today and how important each will be for the knowledge utilization systems of tomorrow. These value choices then become the basis of organized research efforts in which we study the gaps and barriers and in which we search for ideal models from existing practices which might later apply to many situations around the world.

For example, we have just finished a project in which we compared six U.S. federal information services in different topic areas. One of these, the Congressional Research Service* has developed a capacity for very rapid targeted replies to questions addressed to them by congressmen. Replies are tailored to the length and depth requested and in most cases represent a full digestion and interpretation of all available information. This is a remarkable operation, and I fear, one which would be impossible to duplicate for a large number of users across the world. Nevertheless, such systems may have components which are transferable. Certainly they should be studied to determine which of the many social and technical innovations in the information field are appropriate components of a world system.

This brings me to my second point, that such research on knowledge utilization must be applied to improving the existing system. There is already a wealth of knowledge on information flow, the diffusion of innovations, communication, social psychology and the economics of scientific information as a commodity. There has also been a great deal written on the dynamics of change in individuals and organizations, but we have not put this helter-skelter of findings and theory together in a unified approach to knowledge use.

*Formerly known as the Legislative Reference Service.
We have some evidence from a recent project in our center that there is a tremendous thirst for improved utilization procedures among the highest layers of government. In his project, my colleague Nathan Caplan selected approximately 300 policy makers at assistant secretary, undersecretary, and other super grade levels, and asked them to respond to a two hour interview concerning every aspect of social science use in policy making. With few exceptions, the response was tremendous. It was clear that these people were glad that such a project was being done and were eager to see what they could learn from it.

All this leads me again to raise the question with you. How important is research utilization? If it is very important, then we must design the WISE system so that research on utilization process is a integral part of it and so that the results of such research continually feed back to the WISE governors to help them steer a better course.
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