THE UTILIZATION OF NATURAL HAZARDS RESEARCH*

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SUMMARY

This paper is based on case studies of nine R&D projects on natural hazards topics. Each project reflected some new idea--e.g., developing seismic risk maps, reducing the hazards from unreinforced masonry, developing synthetic accelerograms, and analyzing hazards insurance. The case studies determined how and why these ideas were utilized in policy, practice, or commercial settings, thereby improving our knowledge of R&D utilization processes. The results were also the basis for recommending future procedures whereby increased social benefits could be derived from R&D projects.

INTRODUCTION

How to make research more useful has been an important question for public policy, due to the sizeable investments in R&D--in natural sciences, social sciences, and engineering. Thus, legitimate issues may be raised regarding the ultimate societal benefits from this R&D.

This process whereby R&D is eventually put to use is itself susceptible to empirical inquiry. Numerous studies have been conducted on "technology transfer," "R&D utilization," "diffusion," and "implementation" (e.g., Refs. 1,2). Each topic varies in its focus, but the essential theme is the same--i.e., how new ideas are converted to action. However, most of these studies have been done in fields other than natural hazards research, such as in education, gerontology, and psychology (e.g., Ref. 3).

The purpose of the present investigation was to corroborate the prevailing theories and propositions in the natural hazards field, where R&D has covered multiple disciplines, but where few previous studies of

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R&D utilization have been made. Also, natural hazards researchers themselves have become aware of the need for improved utilization procedures, and funding agencies such as the U.S. National Science Foundation are in a position to implement these procedures.

RESEARCH DESIGN

Research Questions

The main questions addressed by the study were the following:

- Does the utilization of natural hazards R&D follow a common set of processes, or has each utilization experience followed an idiosyncratic path?
- What differences in the utilization processes, if any, are found among the natural, as opposed to social science fields represented by R&D in natural hazards?
- What generalizations, if any, can be made about the utilization process for natural hazards R&D, and how do these compare with those in other fields?
- To the extent that common utilization processes exist for natural hazards R&D projects, what interventions, if any, can be suggested to improve these processes in the future?

Answers to these questions required an investigation of the actual experiences of natural hazards R&D projects. In the present investigation, a given R&D project was the topic of a single case study, with the goal of the within-case analysis being to document the utilization process as it occurred for each such project, and the goal of the between-case analysis being to emphasize the replication of patterns across different R&D projects (Ref. 4). The specific issues studied and the data collected were as follows.

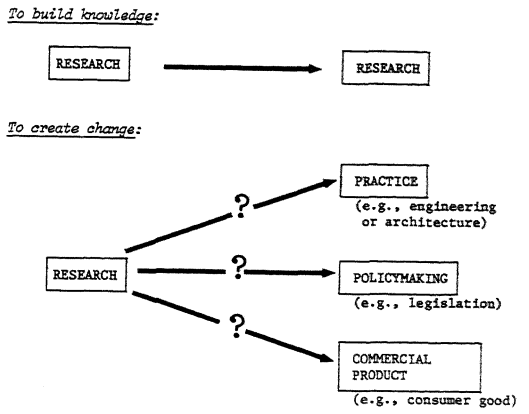
Different Types of Research Utilization Outcomes

R&D ideas can have several different types of "end-uses," as diagrammed in Fig. 1. An important distinction is whether the R&D will be used by other research investigators (to build knowledge about a topic), or by non-research personnel--i.e., for practice, policymaking, or commercial purposes (to create change).

R&D use by research investigators is a well-known process, involving a community of scholars, academic publications, and scientific networks (e.g., Ref. 5). More important for the more immediate concerns of public policy was the second set of end-uses, in which R&D can lead to changes in practice, policymaking, or commercial products. This second set of outcomes was the target of the case studies.

Figure 1

TYPES OF RESEARCH UTILIZATION



Theoretical Models for Explaining Research Utilization

Previous research on R&D utilization already suggested several major ways of achieving these types of end-uses. Seven explanatory models had been extracted from the variety of previous investigations in other fields (Refs. 6,7) and are summarized in Fig. 2. Each model suggested the relevance of a slightly different set of events for any successful utilization experience. For instance, the Research, Development, and Diffusion (RD&D) Model predicted a linear sequence of types of research, followed by commercialization and use. The Problem-Solver Model, in contrast, suggested the existence of a problem as an essential predecessor to the onset of research and later utilization. Finally, the Social Interaction Model postulated the existence of active social networks of research investigators and research users, and the occurrence of important communications between these types of people, both during and after specific R&D projects.

These models were considered rival explanations for the utilization process. Where the actual pattern of events followed that predicted by one model but not the others, the case study was said to support this explanatory model. Thus, these various explanatory models were used to suggest the data to be collected for each case study, over and above the types of end-uses previously described. Of the seven models, greater attention was given to the first three, as these were deemed more relevant to the natural hazards field.

The conceptual framework therefore consisted of: a) the possibility of different types of end-uses (i.e., dependent variables), and b) the tracing of various events (i.e., independent variables) predicted to occur as part of different rival explanations for these end-uses.

Figure 2

SEVEN MODELS FOR EXPLAINING RESEARCH UTILIZATION

Name of Model	Explanation of Utilization
Research knowledge is used because:	
1. Research, Development, and Diffusion Model	...an idea developed by the researcher achieves commercial application.
2. Problem-Solver Model	...research is designed to solve the problem of a specific user.
3. Social Interaction Model	...researchers and users belong to overlapping networks, and communicate during and after research is conducted.
4. Political Model	...research is designed to support a predetermined political position, and is used as political "ammunition."
5. Enlightenment Model	...research leads to new concepts and theoretical perspectives that find their way into common awareness.
6. Research as Intellectual Enterprise Model	...research is accepted as a societal pursuit in which specific uses are not as important as the fact that the research is being conducted in the first place.
7. Tactical Model	...research is commissioned as a delaying tactic, to avoid making a decision or confronting an issue.

Selection of Different Case Studies

In addition, different patterns were predicted for R&D projects due to differences between natural science and social science research. In the natural sciences, and especially in engineering, new ideas typically take the form of tangible, usable products or processes. By contrast, the social sciences typically yield new conceptual ideas that are only infrequently converted to usable products. These different patterns led to the desire to select both natural science and social science projects.

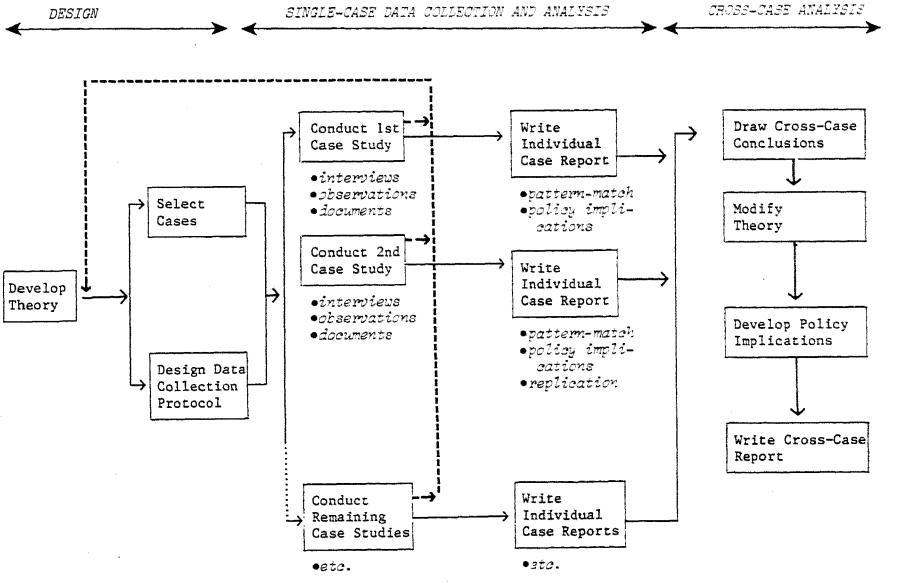
The R&D projects selected were those whose utilization outcomes were already known. This post-hoc definition was needed to assure that the events of interest could be examined. Nine principal investigators and projects were identified: 1) S. T. Algermissen, U.S.G.S., seismic risk map; 2) R. D. Ewing, ABK-A Joint Venture, unreinforced masonry; 3) H. P. Friesema, Northwestern Univ., long-term consequences of disasters; 4) D. E. Geis, AIA Research Corp., design guidelines for flood damage reduction; 5) G. W. Housner, Cal. Inst. of Tech., synthetic accelerograms; 6) H. C. Kunreuther, Univ. of Penn., hazards insurance; 7) T. Margerum, Assoc. of Bay Area Governments, local government liability; and 8) H. B. Seed, Univ. of Cal., soil liquefaction.

Data Collection Methods

The overall approach was a multiple-case study design, diagrammed in Fig. 3. In the data collection, emphasis was placed on the development of converging lines of evidence, consisting of interviews, observations, or the examination of documents such as research proposals and reports. This pursuit of converging lines of evidence, regarding the essential facts of a case and the potential support for the various explanatory models, is an extremely strong and powerful form of case study research (e.g., Ref. 8).

Figure 3

THE CASE STUDY METHOD



RESULTS

Individual Case Studies

The individual case studies showed similar patterns of utilization. To make utilization occur, the investigators had developed various ways of communicating with the potential users of the research, whether through: presentations at formal meetings, participation in professional organizations and workshops, the convening of user-dominated advisory panels, or other devices. These results supported the Social Interaction Model as an explanation for R&D utilization.

The communications were two-way and highly interactive; moreover, they occurred throughout the life of a research project, and not merely at its conclusion. In this sense, a major finding was that research utilization begins when R&D begins, and is not a sequential step that only follows the completion of the R&D. Although widespread dissemination of the completed results, in the form of written reports and oral presentations, is an important later activity, this activity serves to reinforce earlier communications but is not itself the basis for initiating the utilization process.

In many of the cases, the research also was designed as a result of some prior problem having been identified. Discussions among different types of users and officials of R&D-funding agencies, in fact, frequently occurred as a prelude to research being proposed in the first place. To this extent, the results also supported the Problem-Solver Model as an explanation for R&D utilization. In none of the cases, however, were the other explanatory models substantiated.

Especially important in all of these cases was the role of professional organizations as a forum where research producers and users could interact. These included regional associations--e.g., the Association of Bay Area Governments or the Structural Engineers Association of Southern California; as well as national associations--e.g., the National Academy of Sciences or the American Institute of Architects. Where formal associations were not prevalent, the research investigators actively reinforced their own networks. These various interactions served to produce a marketplace of ideas, in which researchers could learn about (and be critical of) users' problems while still formulating and designing their research, and in which users could learn about (and be critical of) the new research that was being started or likely to be concluded in the near future.

The specific pattern of results in each case study is covered in individual reports produced as part of the present investigation (e.g., Ref. 9). Each report lays out the specific events that occurred (or did not occur), relevant to the different models, as well as the utilization outcomes that were found. In some cases, utilization was extensive, such as: a) the passage of ordinances governing the retrofitting of existing, unreinforced masonry buildings; b) different approaches to

hazards insurance by the insurance industry; c) reorientation of national policies with regard to concern for the social consequences of natural disasters; and d) changes in zoning and building codes as a function of seismic risk maps.

Cross-Case Patterns

Substantial differences between natural and social science projects also were found. In particular, the utilization of social science ideas was difficult to trace, because such ideas were integrated into prevailing belief systems and intermingled with ideas from other sources.

In none of the social science cases had the R&D led to a "usable product," whether taking the form of a methodology, a handbook, or a model statute or code. Such products would seem to be an appropriate way of improving the utilization of social science R&D in the future, in comparison to R&D based on the natural sciences.

No other prominent cross-case patterns appeared to be important, with no differences in utilization processes found as a result of such distinctions as: university vs. nonuniversity-based R&D projects; different types of natural hazards; or different fields within the natural or social sciences.

CONCLUSIONS AND RECOMMENDATIONS

The overall pattern of findings supported the following kinds of recommendations for future R&D projects, assuming that R&D utilization is a policy goal above and beyond the simultaneous goal of conducting rigorous scientific investigations:

- That prinicipal investigators actively strive to be part of those professional networks that include the potential users of the R&D;
- That communications between R&D producers and users be encouraged throughout the formulation and design of an R&D project, and not just at its conclusion;
- That social science projects be encouraged to develop usable products, and not simply conclude with the generation of new conceptual ideas;
- That widespread dissemination of R&D results be made once a promising utilization process has been started; and
- That separate support be given to the activities of professional associations in promoting communications between research producers and users.

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