

Setting State Research Priorities

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This paper presents a generalization of the interaction of research management and the priority-setting process. Several concepts of research management and their effects on problem prioritization are evaluated. Several purposes for establishing priorities are discussed, along with the order of priority of basic research and direct problem research. The role of research and the research unit within the agency and the organization for setting priorities are discussed. Two corollaries are presented concerning the degree of formalization for setting the priority of basic research and contract research. Priority-assessing steps are given that augment a general research-management cycle. Future planning of research programs is discussed and a comparison made with planning long-range research.

State transportation departments all have different research units to assist in solving problems. Presumably, these research groups have defined missions and a working chain of command. But do these departments and research units do an adequate job of relating their problems to the needs of, and impact on, the transportation department? In other words, Do they adequately set the priority of their needs? Are these problems properly evaluated with reference to available resources? Are needs and resources adequately combined into a program whose priorities are properly established?

The missions and methods of the research organizations are as varied as the number of state transportation and highway agencies. Research management methods vary from highly formal to casual. Certainly, no single research management plan will work for all state research agencies. Our problems and resources dictate individuality in research programs. Even with this acknowledged individuality, research must provide an acceptable product. The measure of success or effectiveness of this product is the recognition of the degree to which research meets its commitments and requirements within constraints of budget and personnel resources. This, then, is the purpose of setting the priority of research.

MANAGEMENT AND THE PRIORITY ORDER

Principal attention for research management has been focused on such activities as problem definition, development of the research work plan, proper accomplishment of the research, and implementation. A typical research-management cycle is shown in Figure 1.

The setting of priorities is not a prominent facet of research management within the framework of the management cycle shown. Does this imply a lack of knowledge, ability, or interest in the priority order of research problems? Probably not. However, it may imply a lack of formality in setting the priority of research in the management cycle, certainly as compared with problem definition, study design, and implementation of the findings.

If, in fact, we in state research do establish a priority order, what are we trying to accomplish by this? Our objective is to define those studies that will address the greatest needs and offer the greatest returns for the state agency. To accomplish this objective our priority-setting effort has two basic thrusts. One is the establishment of a priority order of research problems to develop a program, then the setting up of the budget resources to accomplish this defined program. This activity might then be entitled "program development." The other thrust is to make optimum use of limited re-

sources to get the greatest possible return from available funds and staff. Both of these directions acknowledge the identification of greatest possible returns to the state agency, but they differ in the way that resource availability is considered. One identifies needs and establishes resources to meet the needs; the other acknowledges resources and identifies needs that stay within those resources.

If we recognize the close interaction between identification of needs and resources, then those who have a responsibility for setting the priority of research should also have input or control capabilities of the agency resources available to the research program. Without these capabilities the research program will probably be a continuous effort of fitting needs into constrained resources. The identification of high-benefit or high-need problems should have management recognition of resource availability for these problems.

THE RESEARCH PROGRAM

The type of research program should be identified in order to better develop a priority-setting process. Basic research and long-range research lend themselves to the process of setting priorities for program development. However, direct problem research tends to be directed toward this process to a lesser degree. A direct-problem research program is generally priority ordered within available resource allocations. Problems defined as immediate needs cannot wait for a program to be developed. In order to start this type of study in a timely manner the general question is, "Can we do this within our immediately available resources?"

A weakness of this direct problem research type of priority ordering is that it may not have an ability to allocate resources reasonably. In the event that a problem develops that has a higher priority than others that are under way and available resources are committed, several options are available:

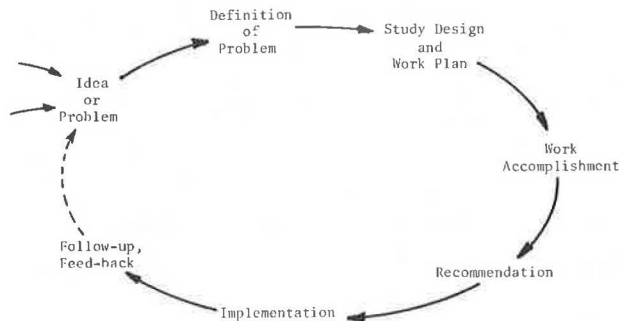
1. Additional resources are developed, which is generally a very difficult task;
2. On-going effort is curtailed so that higher-priority work may start; and
3. We wait, which is not looked on with favor, particularly by those who have the problem.

Yet, a continuous program of direct problem research has a built-in, renewable resource in that the completion of studies generates the availability of resources to undertake additional studies. There is a quicker turnaround of resources available for a continuous, direct problem research program that, in effect, minimizes delays of starting a high-priority study. Setting priorities for this type of program is generally an on-going review of problems and resources and tends to be done informally.

Research Role

The role of research within a state transportation department affects the attitudes and needs for establishing priorities. The organizational position of the research unit and its mission will strongly influence research management or be strongly influenced by management, and subsequently influence

Figure 1. Typical research-management cycle.



the priority order of research problems. In some cases, the research unit may have the primary mission of coordinating contract research, whether that contract research is directed toward basic research or direct problem research. In this case the probable role of the research unit would be to implement a program structured by a recognized group (council or committee) that had reviewed the state agency's problem statements and priority order of a program.

In other cases, the research unit may have the primary mission of conducting in-house research to meet the needs of the agency. Within this role, the research unit may

1. Informally set priorities itself with the advice and counsel of the chain of command of those operating units that have specific problems that might be in competition for research resources;
2. Have the chain of command set the priorities with that supervisor directly responsible for those several operating units that have competitive problems in making the priority decision;
3. Make recommendations to a high-level staff person who interacts with operating personnel and determines priorities; or
4. Make recommendations to a council or committee that makes priority decisions.

In all of these four cases, the probability is that the prioritizing process of an in-house research program will be less formal and more of a continuous activity than that process for contract research. However, if the state agency is principally concerned with long-range, in-house research, the probability of formalization is increased.

In summation, two general corollaries are presented:

1. Research prioritization is formalized to a degree directly proportional to the amount of basic research undertaken and
2. Research prioritization is formalized to a degree directly proportional to the amount of contract research undertaken.

If these two corollaries are correct, then a state agency that has a contract, basic research program would have a greater chance to be more formal in its priority-setting program than a state agency that has a contract, direct-problem-research program. Those state agencies that have an in-house, direct-problem-research program would have a strong tendency for informal setting of priorities. The tone would be low keyed and priority decisions probably would be made at a lower level than for the more formal programs.

Organizational Concepts for Setting Priorities

A state agency involved in research will have some

recognized organization for research. This organization would generally consist of the research unit and an overview and control group. This group may be the chain of command for research, a separate council or committee, or a designated staff position. In any case, the responsibilities of this overview and control group should be clearly defined. It is very important that the agency give some clearly identified group the responsibility of openly receiving problems and needs from personnel of all levels of responsibility, the various disciplines and technical units, and even the geographical areas of the state. Each person must have confidence that the problem (which is very real to him or her, although sometimes not to someone else) will receive sincere consideration.

A research operation or group cannot, and should not, be expected to address all of the problems of an agency. Problems are handled continuously by capable technical personnel in the agency without the involvement or awareness of research. However, some mechanism must exist to allow the person who has a problem that he or she feels cannot get resolved, to bring this problem forth for research and consideration. If a state agency has a good mechanism for receiving and recognizing problems, then it probably has a good mechanism for identifying and setting the priority of the needs to address those problems, regardless of the methods used. Any weakness within an organization that will restrict the recognition of a problem will probably inherently restrict proper ordering of priorities. Problem recognition and priority decisions suffer from inability of the research management to identify the problem because of unfamiliarity or even a fixation of their own problems to the detriment of others.

Another major consideration for the agency's organization for setting the priority of research must be the recognition of all available resources that can be brought into play to solve the problems that are competing for these resources. A research-overview group can review the problems and stratify them into an order of benefit-returns and importance to the agency. This ordered array then would be a form of problem prioritization. But, there is a major abrogation of responsibility to then say to the group that is to get the research done, "Take this list of problems in priority order and go as far down it as you can." The complete priority-setting activity must be done with knowledge of resource availability and must include not only development of the list but also the recognition of how to implement the list, considering resources.

Organizational concepts for setting priorities must be directed to openly allowing and even aggressively pursuing the solicitation of problems not just the review of these problems and determination of a listing of benefits and needs. These concepts must incorporate a broad spectrum of knowledge of resources that are available, or can be developed, to solve these problems. A research overview group that has a mission to set the priority order should be able to produce a program with confidence that they are aware of all of the problems and all of the resources.

Research Problem and Setting Priorities

The research management activities of a problem are shown in Figure 1 and have been discussed to some extent previously. This process is important because the priority ordering of research starts at the inception of the problem and is influenced by all steps that precede the actual priority decision point.

Obviously, the priority-setting process requires evaluation of at least several problems. A single problem can be incorporated into a previously developed list. This single problem can only be evaluated comparatively if it is in competition for resources with other considerations. An expanded listing of research management activities that expressly leads to priority decisions is listed below.

1. Identify the problems,
2. Define the problems,
3. Define the agency needs concerning the problems,
4. Determine the scope of the problems,
5. Define resources needed to solve each problem,
6. Evaluate the accumulative resource needs for the various problems,
7. Set the priority of the problems under consideration, and
8. Develop the study design and work plan.

The process of setting priorities begins with the identification of a problem. The effectiveness of the solution of that problem depends on the thoroughness of each of the steps taken to develop that problem into a research study. The priority-setting process is also obviously affected by these steps. If the problem is not properly identified, its priority will not be properly ordered. This may be a built-in safety factor for a program in that, if a problem is not understood, it is not going to receive major support or a high priority. That problem will be undertaken only if there are surplus resources available and the review-priority-approval authority in effect says, "We do not understand it, but we will do it anyway." This situation probably does not occur very often.

Definition of the agency needs concerning the problem is a direct priority-oriented step. It assists research program managers in assessing the value of the problem solution, which sometimes results in a simple yes or no decision. This type of decision is the most fundamental priority decision possible--either do the work or do not do the work. If the decision is to do the work, then a stratified array in combination with (or competition with) other problems will be necessary. This stratified arrangement is certainly made more meaningful by defining the agency needs and the benefits of the study.

Determination of the scope of the problem is an obvious need in the research-problem-management process. Definition of the resources needed to accomplish the objectives is also a management need that is principally directed toward setting the priority of the problem, in addition to being able to properly evaluate the problem. This management process should require the evaluation of the accumulative needs of the various problems of interest to the agency. This composite resource-needs evaluation gives the agency a general idea of how far it can go to solve all of the problems. This evaluation is considered to be an obvious need of the priority-setting process.

Long-Range Planning

A number of state agencies have research programs that consist of direct, problem-oriented studies. These states identify this type of program as best addressing their needs and fitting their resources. However, it is easy to get so involved in this type of program that the only reaction and thoughts are for now. This outlook easily approaches the "cannot see the forest for the trees" syndrome, where the individual trees (separate, immediate needs and

problems) distract from being able to identify the forest (related problems or a family of problems that are not solved efficiently by a series of separate, disjointed studies). Each agency involved in a program that principally consists of direct problem research should carefully analyze that program and ensure that a problem-review and priority-setting process is built into its research management system that will not only allow, but will force, long-range planning.

Long-range planning is not necessarily the planning of long-range studies but is more directed toward establishment of an overview of direction that can act as checkpoints or benchmarks for a number of seemingly disjointed, direct research studies. This is not to suggest that all direct, problem-oriented studies must fit within some overall plan of research. This obviously is not the case. But, without such a planning program, a state's research course could be plotted by a number of short sights without looking into the distance for a major landmark. Such a course tends to be erratic, have a number of unnecessary changes in direction, and is wasteful of time and effort.

The establishment of long-range goals is an inherent part of an overall priority-setting program. Such a program should also encompass a long-range review and planning for the development of resources to be available for research. An occasional review of the forest should be made to keep a program on course.

SUMMARY

There is no single priority-setting method that the various state transportation agencies can use in their research-management program. Each research program is unique and must be evaluated as such in developing a method for setting priorities.

The order of priority is a direct responsibility of research management, and both the needs for research and the availability of resources for research must be considered. Management responsible for the prioritization of a research program should also have authority over the resources necessary to accomplish the program.

The purpose and style of the state agency research program have principal effects on the priority-setting system used by that agency. Two corollaries are presented in this regard:

1. The priority order of research is formalized to a degree directly proportional to the amount of basic research undertaken and
2. The priority order of research is formalized to a degree directly proportional to the amount of contract research undertaken.

There is a strong interaction between identifying the problem and priority-ordering of the problem. A good priority-setting operation begins with a good problem-identification operation. Also, research management must openly allow or aggressively pursue problem recognition in order to best develop a research program of which priority decisions are a part.

In conclusion, Is the setting of priorities of research by the various states a fact or a fantasy? It is certainly thought to be a fact. The research programs of a large number of states are direct, problem oriented, and have little need for highly formalized priority setting. As such, the use of a highly formalized research priority-setting procedure by all states is a fantasy. Too often, the setting of priorities is mentally defined as a highly formalized procedure, which should not be the definition applied to state research programs.