Organizational Analysis of a State Department of Transportation Program Development Process

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Many state departments of transportation (DOTs) are facing serious problems in developing a transportation improvement program that reflects cutbacks in funding and yet meets the demands of constituent groups. The program development process for one state DOT is examined and organizational and process changes are recommended that will improve the ability of the DOT to produce a realistic and credible program. Although this analysis involves only one DOT, the results are relevant to other DOTs as well. An examination of the current problems of the DOT, the development of a normative model for program development, and the use of this model to recommend process improvements are included. The development of a multiyear program, the formulation of a communications plan that describes to constituent groups the rationale and process for establishing priorities, and the use of a management information system are recommended.

Many state departments of transportation (DOTs) are currently facing serious problems in developing and carrying out a transportation capital improvement program. Perhaps most important, cutbacks in government funding have forced many agencies to examine their implementation priorities carefully. These pressures of fiscal austerity, combined with the need to incorporate a broader range of socioeconomic and environmental concerns into the project planning process, have often lengthened and made more complex the planning, developing, and designing of transportation facilities. In addition, because of major changes in the environment of transportation planning, many projects long under development may be less appropriate than they once seemed.

The purpose of this paper is to analyze the project development and programming process of the New Jersey Department of Transportation (NJDOT) and to recommend changes in process and organization that better reflect the current fiscal and political environment (1). Instead of focusing on the development of techniques that could be used to establish project priorities, this study examines the programming process from the perspective of its role as an organizational activity. This perspective required extensive interviews with NJDOT officials at all levels of the organization. Although the results of this study are based only on the experiences from NJDOT, the problems faced by this agency appear common to state DOTs across the United States (2). Thus in subsequent sections many of the concepts discussed for improving program development are related to any DOT facing similar problems as those of NJDOT.

TRANSPORTATION PROGRAM DEVELOPMENT AS AN ORGANIZATIONAL PROCESS

Much of the research that has been undertaken on program development has focused on the techniques that can be used to rank projects by priority (3,4). Until recently little systematic effort was made to examine the process of program development and the organizational characteristics of this process that affect the effectiveness of the program once formulated. A recent report, however, examined the highway programming process in seven states and highlighted the dimensions of such a process that were crucial to its eventual success (5). These dimensions included

1. Laws, agency objectives, and government regulations;
2. Roles adopted by agency management and other agency personnel with regard to programming;
3. Groups potentially involved in the programming process, including highway users, contractors, legislators, local officials, and so on;
4. Stages of the process by which a program is developed (e.g., project initiation and analysis, program draft, program adoption, scheduling, and monitoring); and
5. Program categories in which projects are classified for funding or other purposes.

These five dimensions in essence imply that the process of developing a capital improvement program is an organizational activity subject to the fiscal and political pressures of an agency's external environment and sensitive to structural and behavioral factors internal to an agency.

This perspective on program development presented a challenge in formulating a methodology that was sensitive to these organizational factors. The methodology used in this study consisted of two major steps: (a) a descriptive analysis of the existing process of program development and (b) formulation of a normative model of such a process that addresses the problems found in the first step. Because the program development process was viewed from the organizational perspective, the first step included the identification of organizational units involved with project development, the flow of information among these units, the perceptions of state DOT personnel toward programming, and the influence of interests outside the DOT.

This descriptive analysis identified the following factors that appeared to lead to problems in the program development process:

1. Timetables established for completing projects were often not met, for reasons outlined in the following.
2. Some categories of federal-aid funding available to the state were not always used in a timely manner, which meant that the lag in highway expenditures represented a financial loss to the state in at least two ways. First the beneficial impact on the local economy generated by the influx of federal money was delayed, and second inflation caused a loss in buying power when the projects were ready for implementation.
3. The first two factors led to a credibility problem for NJDOT, making it difficult to receive support from outside constituencies for securing stable funding and increased staffing levels.
4. There were inadequate financial and personnel resources to achieve the expectations of many individuals both within and outside of the DOT. The process of planning and developing construction projects had become more complicated and expensive at the same time that funding cutbacks had restricted the level of resources to carry out the projects.
5. Because of external pressures to carry out many projects, design and implementation priorities

often changed at many different points during the course of the project. It was thus difficult to communicate clearly to all concerned parties what the top-priority projects were beyond a limited number of highly visible and politically sensitive ones. The result was a tendency for DOT personnel to become frustrated with the process and for projects to sometimes be lost.

6. Because of the complexity of the overall program development process and because so many factors had to be considered, there was often some uncertainty concerning organizational responsibilities within the department. This was especially true at the beginning of the process when many new projects were identified and when an initial sorting out of priorities did not occur. This problem was exacerbated by the many points in the development process at which projects had traditionally started.

7. Significant staff resources were expended on projects for which there had been a previous commitment but that could not possibly be built because of environmental problems, community disruption, or cost escalation. Paradoxically the same outside groups that were no longer confident in the DOT refused to accept the professional opinion of DOT officials that some projects might be infeasible.

8. A committee of NJDOT officials that had been created to establish priorities and monitor project development provided a valuable function. However, many individuals in the DOT were uncertain exactly what roles and responsibilities were held by this committee.

9. There was a sense among several high-level NJDOT officials that a realistic, multiyear program of transportation improvements did not exist. Although plans and programs were available, funding uncertainty and possible intervention in project programming from outside sources made a multiyear program a difficult document to produce.

10. Although there was a large amount of data available on projects in progress, there were often conflicting definitions of terms and no common data base.

These problems served as the point of departure for the identification of possible solutions and for final recommendations. Again, although these problems were related specifically to one organizational context, it appears likely that many, if not most, of them are experienced by other state DOTs as well.

PROJECT DEVELOPMENT PROCESS: A NORMATIVE MODEL

The project development process provides the basic organizational structure for any DOT to fulfill its mandate. As such, the process must be structured to allow officials to control and monitor the effective and efficient utilization of project development resources. One such structure (or conceptual model) is shown in Figure 1, in which the project development process is shown to consist of four phases:

planning, project development, final design, and advertising and construction. Although it is important to establish this clearly defined and systematic procedure for the overall process, it must never be so rigid that some flexibility cannot be incorporated without destruction of the fundamental objectives of the process.

In order to manage the project development process, it is important to have control points at which decisions can be made on resource allocation based on an assessment of priorities and previous resource commitment. To illustrate what is meant by controlling the flow of a project, a simplified model of the project development process is shown in Figure 2. The gates or points at which key decisions should be made and previous decisions reviewed are shown in Figure 3. Many projects will be examined at the beginning of the process and decisions will be made as to which projects should be developed further. A policy committee of DOT officials, various subcommittees, or the agency heads should make basic decisions on priorities at the beginning of each phase as well as at other intermediate decision points.

At each decision point, there should be clear policy guidance on what types of projects should be advanced. For example, deferred-maintenance projects or those that advance economic development might be given top priority. The criteria at each decision point should thus be clearly articulated by top management.

One of the important characteristics of the project development process should be the insulation from outside influence of technical activities that occur between decision points. The individuals responsible for these activities are thus capable of determining what they can actually produce, given current demands and resources. The manager of each of the appropriate phases should be viewed as a gatekeeper who participates fully in all decisions as a project passes from one phase to the next. Thus the gatekeeper function is one of providing a realistic estimate of what is feasible in project development given the other responsibilities of a particular organizational unit.

Rather than allowing projects to enter the pipeline on a continuous basis, it would be worthwhile to establish batches of projects at the decision points so that trade-offs can be made. Such a system would permit an assessment of the resources needed to complete the project and would also provide a better opportunity for DOT personnel to judge the project interconnectedness and geographical distribution. Knowing which projects are entering any particular phase of the process allows one to reallocate resources to adjust for the different times it will take for projects to complete the process.

Project status information is necessary at the decision points to determine which projects should progress to the next phase and to determine where bottlenecks in the process are likely to occur.

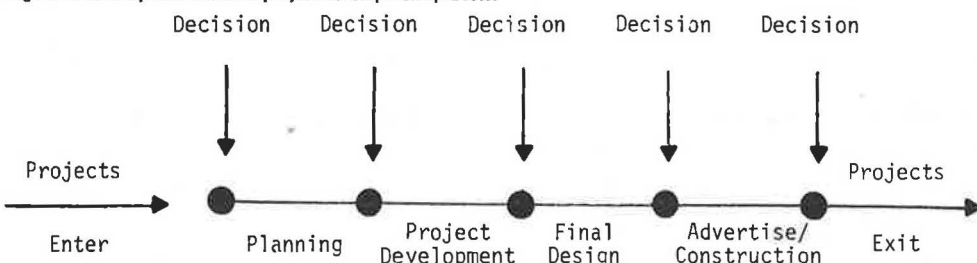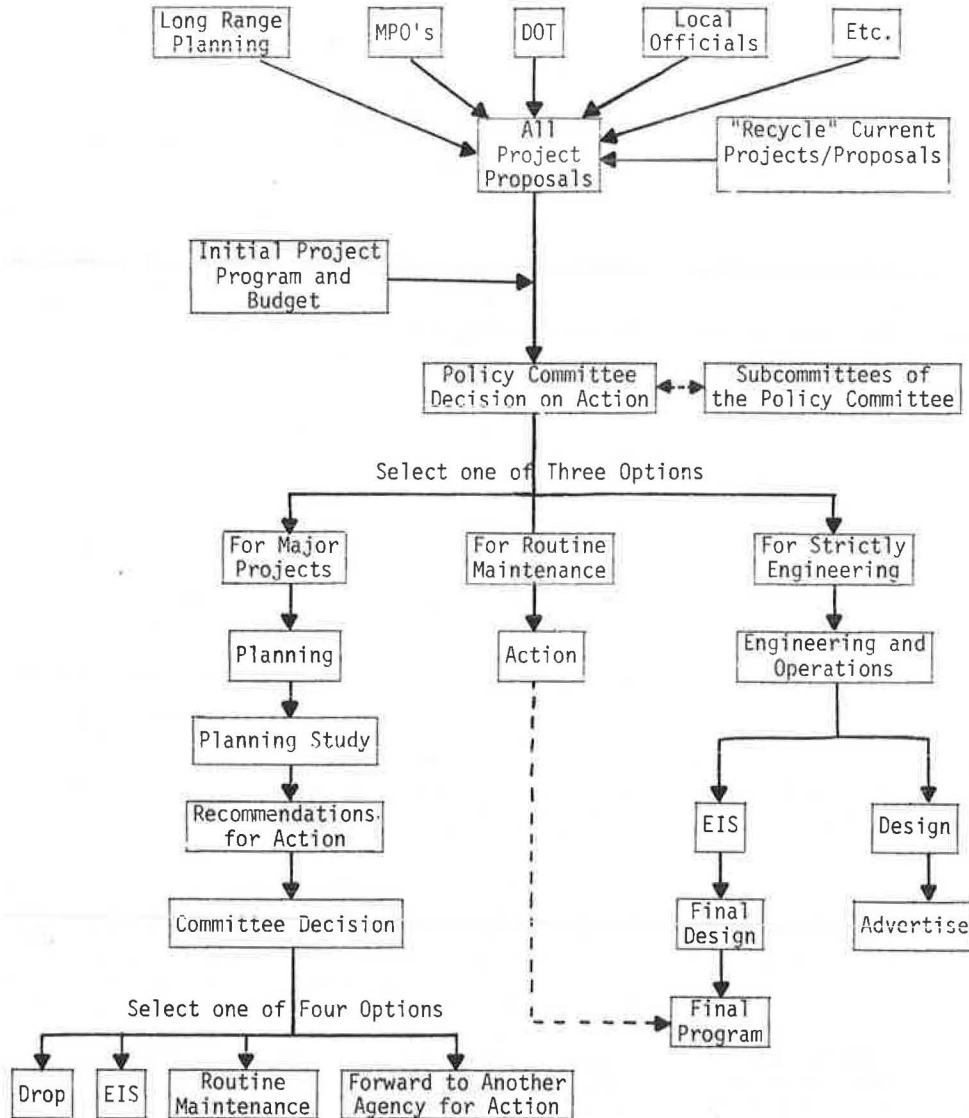Figure 1. Conceptual model of project development process.

Figure 2. Simplified model to control project development process.

This information need requires some form of management information system (MIS) to produce the information on a timely and consistent basis.

Because the decision points are considered gateways to the next project development phase, different types of meetings will be necessary. For example, meetings will be needed to decide which projects deserve to go into planning, into project development, or into construction; other meetings might be necessary to assess the progress of the most critical projects; still others might be necessary to examine the relationship between the program and the budget. In each case specific types of information would be needed to support decision making.

APPLICATION OF THE NORMATIVE MODEL

The model of program development just described provides an image of a process that recognizes valid external inputs into program development and yet provides internal agency controls that order the process systematically. Several aspects of this model, especially as it relates to the New Jersey case study, merit special attention.

Organizational Mechanism

Some organizational mechanism is necessary to guide the program development process. In the model discussed earlier, the departmental policy committee provides this guidance. For such a committee to work, however, its roles and responsibilities must be clear. Further, regular meeting schedules must be established and agendas prepared in advance.

Schedule

It is also essential that an agreed-on schedule be established for obtaining inputs to the development of a realistic multiyear program. In order to obtain these inputs in a timely fashion, clear communication must be established that will (a) clearly but briefly describe the process used in establishing the program, (b) specify the organizational responsibility for the submission of information so that ambiguity concerning individual responsibilities both inside and outside the department is eliminated, and (c) describe the consequences of failure to meet schedules as indicated.

Figure 3. Role of policy committee.
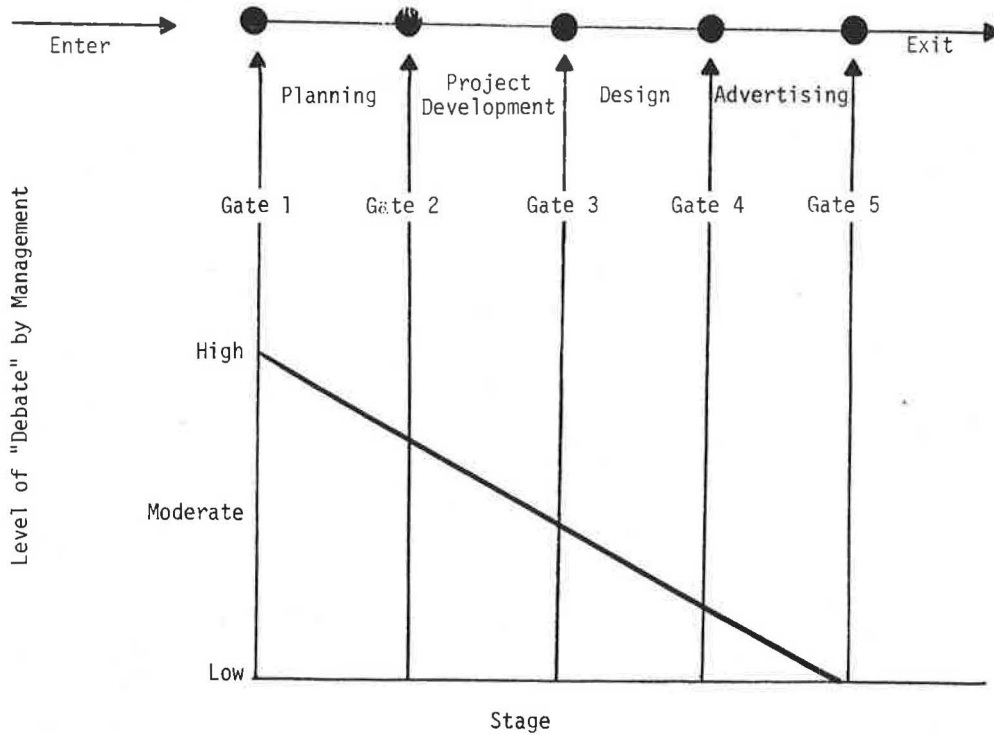
Functional and Financial Categories

In order to relate DOT objectives to program implementation and success, the program should be developed by placing projects into various functional and financial categories. The agency head must establish clear program objectives for each program type, and the policy committee must relate these objectives to cash flow and realistic budget considerations.

Program Support

It is essential that both personnel and financial resources be scheduled realistically and accurately in order to establish credibility concerning the ability of the DOT to produce and support the established program.

Communications Plan

The DOT must develop a communications plan that describes a clear rationale for establishing priorities and that will establish the credibility of the DOT with its many constituencies as new projects are proposed in the future.

MIS

An MIS that provides useful and reliable information to the DOT officials is a critical component of a program development process. There are five major characteristics of such a system that must be considered for the MIS to successfully support the model shown in Figures 1, 2, and 3.

Relation of MIS to Decision-Making Structure

The information system must be related to the structure of decision making. For example, if the structure of decision making for project development follows a process that, in general, consists of

planning, project development, engineering and design, and advertising and construction, the information system (or systems) must be capable of providing information in each step. Major decision points that occur in this project development process should be supported with the information necessary for informed decisions.

Relation of MIS to Decision-Making Purpose

The information provided by the information system should be related to the purposes of decision making. This requires that major actors identify the information necessary for them to make decisions. Often higher levels of management do not need excessively detailed information on every project beginning or currently in progress. Their measure of agency performance is much more aggregated than the project information generated by the organization. However, middle-level managers might well need specific details on tasks not accomplished and the reasons for the delay. The information system must thus respond to the differing needs of the management structure in an agency.

Relation of MIS to Decision-Making Level

The information system must provide consistent, reliable, and timely information for all levels of management decision making. In many organizations, there are often many different units that provide information on each individual project. Depending on how this information is obtained and how the major reporting terms are defined, these different units could provide inconsistent and even conflicting information on individual projects. One common solution to this problem is to have a unified data base for all reporting functions that is formatted at a level sufficient to provide the most detailed information necessary for midlevel management needs but that can be easily aggregated to provide the

information required by higher-level management. This information must also be updated periodically to fit the needs of the decision-making process.

Ease of Use

The mechanics of using the information system (initial project input, updating, and information retrieval) must be easy to understand and use. The usefulness of any information system depends to a large extent on its level of difficulty. If a large amount of manual effort is needed to obtain and organize information, the information system is likely to be costly and create inefficiencies in the use of personnel. The initial effort of developing the information system and of institutionalizing it within the agency will most likely require substantial amounts of resources (in terms of funds, personnel, and time), which should be expected by top management. A successful information system, however, should have the capability to maintain and update the data base with minimal resources.

The updating procedures should be easily understood and carried out by those who have the primary information sought. Thus if line managers in the organization are periodically required to report information on project status to a centralized office, the forms for doing so must be easily used and the line managers must view this task as important enough to warrant their time. Ideally the systems should be structured so that those whose timely input is needed get some short-term benefit from providing it in terms of usable information.

Care in Establishing MIS

Implementing an information system must be carefully undertaken; care must be taken to establish credibility, utilize existing resources to the greatest extent possible, and provide for future development of the information system. Because information is so important for the effective operation of an organization and given the often large number of organizational units involved in information flow, establishing an information system can become a complex and controversial effort within an agency. Serious thought must be given to the strategies that can be used to set up such a system, e.g., whether an agency should completely overhaul its information-processing capabilities and issue directives.

CONCLUSIONS

Many state transportation agencies are facing serious cutbacks in staff and funding resources at the same time that demands for improvements to the transportation infrastructure increase. Although much research has been undertaken on the techniques that can be used to set priorities in program development, little work has been done on program development as an organizational process. The program development process in one state DOT has been examined here and a normative model of such a process has been formulated. Although specific to this organizational context, the results of this analysis appear applicable to other DOTs as well:

1. The project development process should be viewed and explained to constituent groups as consisting of a specified number of phases. In this study the phases were planning, project development, final design, and advertising and construction. Specific decision points should exist between these phases at which the worth of projects determines

whether they enter the next phase. A policy committee or its subcommittees should make these decisions.

2. The projects should be batched at these decision points to permit easier assessment of trade-offs.

3. The policy committee meetings should be structured to permit specific tasks to be accomplished. For example, there should be meetings to decide which projects should progress to the next phase. In these meetings, officials responsible for undertaking the next work assignment should be present to determine whether the DOT has the capability to undertake the project.

4. Staff resources should be provided to the policy committee and its subcommittees that reflect the specific purposes of the meetings.

5. Policy and decision rules should be provided by top management at each decision point to permit attainment of priorities. These decision rules should be fine-grained and specific enough so that committee members know exactly what is wanted and staff work appropriate to these concerns can be prepared. For example, the DOT secretary might want to develop ratios of project types that should pass each decision point by type of project (reconstruction, new capacity, bridge rebuilding, and so on).

6. When each project comes to a decision point in the process, it should be analyzed to determine benefits and costs and incremental benefits and costs associated with big projects rather than modest solutions.

7. The decision to move a project to another phase should be based on the comparison of benefits and costs. Although this comparison is not the only factor in setting priorities among competing projects, only those projects that show more benefits than costs should be processed.

8. An MIS is critical to the success of a program development process. A unified data base, including cost schedules and budget information, is the basis for such a system.

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