ROADBLOCKS TO EFFECTIVE MANAGEMENT OF AUTOMATION

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Many highway departments do not manage their computer personnel adequately. Managers tend to accept unquestioningly whatever they receive from computer professionals. This problem does not stem from the position of the data processing unit in the organizational structure; it is one of management education and involvement. A recent study found that the actual location of the unit in the organization made very little difference as long as it was within two levels of the chief executive. What is essential is that the data processing manager be given an executive role and that he be allowed to interact effectively with the organization's other executives.

In many agencies we find the automation function under the supervision of the chief financial officer. This is a throwback to the early days of automation when the computer functioned mainly as an accounting machine. Though the continued location of the computer unit under finance might seem anachronistic, it has been shown that this too had little effect on the efficiency or quality of computer services. In short, then, the actual location of the data processing section within the organization is relatively unimportant as long as it is high enough on the organizational chart to give it the stature it needs to effectively operate and influence decision-making. What is important in locating the automation function is that it not be isolated and insulated from the remainder of the organization. Regardless of its physical location, the data processing section is the central nervous system of an organization.

A problem in many organizations is the decentralized nature of the computer application process. Highway departments are large organizations, and often there is needless duplication of effort by separate divisions. Divisions should develop their own request, and cross-check to ensure that other divisions are not doing the same work.

What are some solutions to these problems? Each department has unique agency-oriented problems; therefore every solution will be a little different. However, there are a few general suggestions that can be applied in all situations. A management steering or review committee should be instituted in each department. All managing levels should be taught how data processing works. Finally, the data processing director should be a member of the management team.

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Effective management of automation involves the same principles as does effective management of anything else. These principles are as follows:

1. Planning—setting goals and objectives and developing strategies;
2. Organizing—assigning responsibility, budgeting, and staffing;
3. Directing; and
4. Controlling—monitoring performance and taking corrective action.

Although data processing decisions fit into a defined set of management activities, there are unique management problems in the data processing field. The most common decisions we must make concern the following: feasibility, alternative selection (spec-

ification of results and changes in user operations), priority, schedule, resource allocation (budget), level of service (response time), security of data, and evaluation and approval of results (audit).

DECISION-MAKING PROBLEMS

One of the primary problems in making decisions is the rapidly changing data processing environment. The speed of technological advances in computer capability, coupled with the large development time for many of our systems, creates difficulty in decision-making about feasibility, alternative selection, and level of service. For example, what is not technically feasible today as we begin development of a computer system may be feasible and, in fact, may require a different decision 2 or 3 years from now when the system is finally implemented.

Another problem is that of finding the decision-maker. Decisions on data processing systems do not fit neatly into the line organization chart as do many decisions in well-established functional areas of responsibility. This is particularly true of large complex systems and those that cross functional lines, where an initial decision must be made as to who is responsible for the proposed program. The resulting problem is that many data processing system decisions must be made at a high level in the organization by a decision-maker who has responsibility for all affected functions.

The timing and scope of decisions present another problem. When and by whom are decisions made about alternatives, level of service, security of data, and priorities? Is there but one decision point in the development of a project, or are there several for each type of decision? Is an original decision regarding feasibility of a project a commitment to complete development without an effective opportunity for further management review?

Communications raise yet other questions. Are data processing personnel getting a clear picture of the users' needs? Are data processing personnel giving users all of the information they need to make an effective decision? This is a particularly difficult problem for those decisions and alternatives that will significantly affect the way in which the user operates, i.e., whether the proposed system eliminates activities, merges functions, or requires greatly different skills.

Another problem is competition among users for limited resources. Although this roadblock is not peculiar to data processing, it again requires decisions on resource allocation, priority, and schedule to be made at a high level in the organization.

Although many computer systems have easily identifiable benefits in reduced personnel requirements and operating costs, many others have intangible benefits that are difficult, if not impossible, to quantify. Systems in this category would include those that provide improved management information and information or analysis capability that previously did not exist. It is difficult, for example, to estimate the value of being able to examine many alternative structural or highway designs.

An effective plan for data processing systems development is the key to solving problems created by automation. This plan must include top management direction and the objectives of the user so that guidelines and procedures can be developed that will allow delegation of decisions to appropriate levels. The plan should include top management's goals and policy, level of data processing effort, degree of in-house operation versus contracted work, centralized versus decentralized operations, and system development. Trends affecting data processing should be defined for various functional areas. The highway department's commitment to an automated accident surveillance system, automated design procedures, and maintenance management system should be clearly outlined so that all levels of management are following the same plan. The plan should also contain estimates of resource requirements so that department management can provide for proper budgeting and staffing.

The responsibility for each system decision should be assigned. The plan should indicate who is responsible for cost-benefit estimates, which decisions are appropriate for districts and headquarters managers, and which decisions should be made by technical personnel and which by management. There is no easy answer for multifunctional

systems, but the responsibility must be assigned to either the manager of one of the user functions, a committee, or a higher level manager.

The system development process should also have definite decision points. This allows the user and top department management to make better decisions on resource commitment, priorities, and schedules. As a minimum, decision checkpoints should follow a feasibility study or conceptual design, detailed system design, coding and testing, and a post-implementation audit to ensure that the system performs as expected. These checkpoints are analogous to those in the development of highway plans, i.e., a planning study with approval of a project report, review of geometrics and other design features, buying the constructed highway improvement, and follow-up operational review.

The data processing system development process should include a communications and work-flow network that requires users to be sufficiently involved in the functional area systems. This includes decisions on feasibility, priority, training needs, and level of service. The process should also guarantee that all requests for data processing be identified and then evaluated by the proper level of management so that no request is ignored and no systems development is begun without appropriate management approval.

My suggestions certainly do not provide a complete solution to all of the problems encountered in making data processing system decisions. However, they are the essential elements of a management process for development of data processing systems.

Eugene Bardach, IBM Corporation

Maintenance of computer software is in many ways analogous to maintenance of highways. It is not necessarily the additional mileage that creates the maintenance problem even though it is a factor. Developing and maintaining the complex variety of computer software are major functions of data processing staffs. Highway departments have for a long time utilized engineering consultants, and I submit that they should investigate the use of data processing consultants. These consultants can offer specific capabilities that the highway department cannot maintain in its staff.

The data processing consultant for computer software should carry the project through its entire course including maintenance. I am leery of those who are willing to design a system but are not willing to go further. My major complaint is that they gain a lot of expertise relative to the problem in the analysis and design phases and then leave with that expertise. The highway department pays for the departed knowledge. There is a trend toward performance clauses in software contracts. Of course, one must expect the cost of the software to reflect the added risk on the part of the contractor.

No highway department can afford to develop all the software it needs whether that development effort be internal or contracted. Great economies can be had if several highway departments join together and contract for a given software system. The difficulty is obviously being able to define a set of requirements agreeable to all. However, complexities and comprehensive capabilities desired in the management information systems of tomorrow will require such cooperative development efforts.