Abridgment
Information-Related Needs in the Transit Industry

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An analysis of discussions with representatives of more than 30 transit agencies is presented. This occurs in the context of the goals of the UMTA-sponsored Operations and Planning Support (OPS) Program to develop and promote tools that incorporate computer technologies to address problems faced in the transit industry across the full range of functional areas (finance and administration, maintenacne, service provision, and service development). Current and anticipated capabilities in each of the agencies as well as task-based needs for automatic data processing are assessed. The findings take into consideration constraints that exist among transit agencies that are likely to implement the proposed innovative management tools. It has become evident that both the attitude toward computers and the organizational setting are particularly important in determining the success of innovations and the kinds of needs designated as critical. A summary of informational concerns as well as actions to be taken is presented.

The purpose of this paper is to continue the dialog between the federal government and the American transit industry related to information needs. It is important to clarify what constitutes a need and to determine which needs would be most effectively meet through federal assistance. At this time, the Operations and Planning Support (OPS) Program, sponsored by the UMTA Office of Methods and Support is designed to promote the use of productivity-enhancing tools, both manual and automated, in the public transit industry. In the first section of this paper the background and motivation for the assessment of needs are presented. The remaining sections summarize conversations with individuals at various transit agencies about their needs for computer-based tools.

BACKGROUND AND MOTIVATION

It has become evident in recent years that the proper combination of circumstances for improving productivity in the transit industry exists for more agencies than those few that are innovative. In the face of indicators, such as declining passenger-revenue ratios, there has been a general push for greater efficiency. The industry is exploring the role of new, often computer-based, management tools in solving these problems.

Central to the discussion of new tools is a concern for handling large volumes of data so that managers can use resources more effectively. Because of the federal government requirement to collect and report specific items of data regularly, there is no longer any question whether agencies have data that would be useful to management. In addition, a number of agencies now routinely collect ridership, revenue, and maintenance-related data not required by the federal government but which they need to decide how to adjust the deployment of human and vehicular resources over time and space.

It has become evident, however, that most of these data are aggregated (e.g., one number for systemwide ridership for a month) never again to be used for a specific area or time of potential interest (e.g., a particular route in the off-peak hours). Often this failure to use data originating from a lower level of aggregation stems from not having the staff to sort through reams of paper stored in an inconvenient location. After data have been aggregated it is almost impossible to retrieve individual pieces (e.g., comparing ridership for a specific route over each of the past 365 days).

The speed with which data-handling equipment has become widely available is also a factor in the increased interest in management tools. The advent of small, cheap microcomputers with standardized components and peripheral equipment has made computers affordable by most transit agencies. They are especially attractive to managers in smaller operations who have been previously dependent on outside agencies or consultants when substantial volumes of data were to be processed and analyzed. For many agencies, payrolls have been the only operation that has been computerized to any great degree.

Microcomputers that can be configured with a larger system (minicomputer or mainframe) or stand alone, combined with the increased availability of software (i.e., sets of instructions used to process and analyze data in the computer) has created a receptive climate for proponents of new management tools. This climate is perhaps the most critical factor directing attention toward improved techniques.

Because no specialists are required, managers, particularly those in smaller agencies, do not have to be concerned about dependence on outside agencies or an inability to hire and pay for appropriate computer professionals. In short, a manager confronted with mountains of statistics who is willing to consider recently developed tools (e.g., microcomputers and associated software) would probably be willing to discuss and implement information management techniques.

In the OPS Program we have sought to support and take part in the development of tools that can be tailored to the needs of individual transit agencies. Nevertheless, we assume that it would benefit the industry as a whole to encourage the design of managements tools that are compatible with the current and anticipated needs and capabilities of most agencies.

NEEDS AND CAPABILITIES RELATED TO COMPUTER-AIDED TOOLS

This section includes documentation of developments related to computer-aided tools of transit management and is based on conversations held with representatives of more than 30 agencies during the fall of 1981. Agencies were contacted in every region of the United States, representing a wide range of sizes (from 12 to more than 1,000 peak-period buses), experiences with, and attitudes toward tools for managing information resources. For the most part, conversations were structured to gather explicit information from transit agencies about their current capabilities and recent experiences with computers. This section also highlights the primary concerns that the transit planners and managers who were contacted have about further data-related automation. Most were able to identify one or more functional needs that are inadequately met. By documenting needs and capabilities, a basis is provided for mapping out the boundaries and content of improved techniques. Such techniques obviously cannot be developed in isolation from agency experience or perceived future needs. The types of information sought from operators and a summary of the approach taken in contacting transit agencies are provided. This is followed by an overview of the findings from the discussions.

Focus of Discussions

Previous discussions with transit planners and managers revealed a number of useful insights. On the one hand, a small number of agencies (usually larger than most in terms of number of vehicles) have the appropriate combination of employees, organizational structure, and resources that have led to innovative handling of information. Most of these agencies have already investigated how new data-related technologies could help their agencies. On the other hand, because many agencies lack appropriate resources or have a rigid organizational structure, they may be wary of adopting tools that have not been fully tested.

As in other industries, a few agencies are in a position to go beyond theoretical support to actual implementation. After the concept has been tested and generally acknowledged as useful, most other agencies are likely to give it serious consideration. Earlier telephone discussions (1) also showed that, except for the industry's innovators, little time is devoted in most agencies to the use of data-intensive techniques. Most management of data is manual, and service and operating policies, for example, are often developed without the aid of any formal methods.

In the light of previous findings an attempt was made to obtain three types of information: current and anticipated activities related to data handling and processing, the receptivity of the agency to new approaches, and agency priorities regarding functional needs that are amenable to some degree to computer-based management tools.

Approach Taken

Four phases characterized the assessment of needs and interest in adopting computer-based management tools. The first two phases were designed to sort out information that exists elsewhere. First, prior general (i.e., industrywide) statements of needs and capabilities with regard to the creation and use of information were reviewed. Where possible, these were differentiated by types of agencies (e.g., size) and used as a basis for initiating conversations. Second, a number of innovative agencies were identified. It was assumed that previous interviews and discussions had already summarized most of what can be learned about traditional agencies.

In the first two phases, maximum use was made of key informants such as Service and Management Demonstration (SMD) evaluation monitors at the Transportation Systems Center (TSC), American Public Transit Association (APTA) officials, APTA committee members, and transit industry people. In phase three, questions to be raised during discussions were generated through several rounds of critique and entered onto a reference sheet used to guide telephone discussions, though only loosely and not in the form of an interview. In phase four operators were queried.

Summary of Findings

There is considerable interest among transit agencies in using computer-oriented tools for functions that have been performed manually. Although a few operators feel their manual systems of data management will remain sufficient, most view computers as a means to reduce handling of paper, cut costs, and generate more useful indicators more quickly than is currently the case. A surprisingly large number of transit agencies contacted are already in the process of actively exploring available computers, software, and consultants.

It was never evident what constituted a representative sample of operators for automation of management-related information, nor how to devise an unbiased sampling procedure. As a result, those contacted represent a sample of people who tend to favor innovative approaches and were, for the most part, quite receptive to having further discussions. The reader should therefore not interpret this summarization as necessarily valid for the entire transit industry. It has been assumed that innovations in transit information management have been and will be first introduced by a few leaders in the industry, tested, refined, and then adapted by the majority of agencies to their particular situations.

Three closely interrelated features of the transit agencies contacted warrant careful description. First, the organizational context in which a manager performs creates a framework for making decisions, defining issues as important, and resolving conflicts. Second, current requirements for data gathering and processing are often derived from the organizational context as well as individual inclination to use computer-aided tools in decisions concerning agency management. Third, and overlapping with the second item, agency receptivity to automation depends on the level of familiarity with available options as well as current requirements and projected needs to generate statistical results.

The organizational setting can be characterized by two dimensions: size and complexity. Simply stated, larger agencies tend to be more complex. It appeared at the outset that the larger, more departmentalized agencies would have the resources to try new tools and would have had more experience with computers. This did not hold to be true; although larger agencies are able to attract data-oriented professionals, they are not necessarily more innovative than smaller agencies. Often expenses for data-related items have to be approved by a separate data department. Requests may be received from more than one part of an organization; and because data processing professionals cannot possibly understand the content of each functional area request, decisions are not always made that satisfy area needs.

A further barrier to innovation is that larger organizations tend to get locked into a particular type of data processing. After a commitment has been made (in terms of hardware purchased, procedures developed, and personnel hired and trained), it is sometimes difficult to shift, particularly if a shift implies lessening the control data processing professionals have over data-related resources.

In small (fewer than 100 buses) and medium-sized (100 to 400 buses) operations, an inability to support a separate data processing staff can be seen as a hidden strength. Another agency or a service bureau can be consulted as needed and no commitment to a particular technology has to be made. Not all smaller agencies, however, have used this independence to their advantage. Some have used their inability to have a separate data processing staff as an excuse to avoid any large-scale manipulation of data or at least to restrict automation to the processing of payroll and accounting information.

The very small agencies (fewer than 50 buses) tend to be the least structured (their professional and administrative staffs may consist of only two to five people) and also the most flexible in using data resources. One professional in a small agency told of treating a request for a microcomputer, disk drive, and printer on a par with a request for office furniture. This is in stark contrast to larger agencies (more than 500 buses) where several layers of approval are required, often by people who do not understand the technologies or the problems confronting the department that submitted the request.

Nonetheless, smaller agencies may tend to be provincial and have less contact with the rest of the industry. Hence their managers are often less knowledgeable about cost-saving innovations than those in larger agencies.

The second major insight derived from the discussions is that there is a close relation between the data collected, the ability to process such data, and the ultimate use of the data in making operational and management-related decisions. Many agencies now collect financial and operating data as required by Section 15 of the UMT Act (as amended). It is evident, nonetheless, that these data are not often used in a manager's decision-making process.

A number of agencies appear to collect the data in whatever way satisfies the minimal requirement, whereas others integrate Section 15 items into a larger scheme, often collecting data disaggregated by routes, market segments, and times of day. Most of the agencies contacted are of the latter type, although it can reasonably be supposed that a majority of all agencies tend to be like the former.

There are two extremes in terms of capabilities to process and analyze data. The transit agencies whose staffs have access to equipment and data processing professionals and know how to use them to good advantage tend also to be the agencies that collect more usable data. The less ability there is to process data, the fewer items of data will be collected and subsequently used in the process of managing an agency's resources. For example, in response to the need to forecast revenues and costs for future years, many agencies would collect considerably more detailed data than they do now if they were able to play out "what-if" questions for any number of variables (e.g., fares and labor costs).

In a 30- to 40-minute telephone conversation, it is difficult to assess precisely what range of capabilities exists among the agencies contacted. It is safe to state, however, that those agencies that already collect or are anxious to collect and use more disaggregated data (e.g., maintenance data on individual buses or ridership by route) will be more likely to consider computer-aided management tools than those that do not.

The third primary insight generated from these conversations with operators is that manager familiarity with the range of options in automating various functions strongly colors willingness to discontinue manual processing of data. At one extreme managers are apprehensive about anything related to computers or mathematics and have made no effort to learn about automated systems that could improve their operations. At the other extreme are managers who have computer training or experience working with computers and have no hesitancy considering every reasonable means to increase the level of automation. In the middle, of course, are the majority of managers who are somewhat familiar with computer-related options but do not have time to evaluate them. Within the small group of managers who have already used computers widely it is interesting to observe that some perceive a strict division between technical staff as processors of data and themselves as consumers of summary reports and charts provided by the staff.

SUMMARY OF INFORMATION-RELATED NEEDS AND CONCERNS

It should be apparent from the previous section that an agency's organizational structure can create pressures to automate in a particular manner. Top management may identify serious problems in one sector of an agency and instruct technical employees to focus their attention on that sector. At the same time, the definition of information-related needs may be colored strongly by what tools have been recently, or soon will be, acquired. For example, several agencies were preoccupied with their new electronic registering fareboxes (Duncan) and wanted to adapt any functions to be automated to the data they would be able to collect with them.

Several needs were identified that were common to agencies of all sizes and organizational types. Many planners and managers believe that large volumes of data cannot be used well and would welcome any means to simplify the gathering and processing of the data. A sizable number of them focused primarily on these mechanical processes rather than on what could be done with them. Because speed is essential to the success of an information system, many complained of a long wait between gathering data and actually being able to use such data. For example, the service planners contacted expressed a strong need for a reliable means of evaluating the best routes and times of day or week to alter service. Surely, tools that would help generate disaggregated indicators before decisions for the next planning period are made would receive widespread attention.

Many operators in agencies of varying sizes mentioned an interest in automating maintenance and investory files. In a larger one, the person contacted pointed out the need to improve the scheduling of buses for repair and to have a better system for checking the status of outstanding work orders. A planner in a medium-sized agency said that costing maintenance jobs was important. A manager in a small agency went further: having a breakdown of costs by parts and knowing the availability of each part would improve his operation. Another manager in a smaller operation believed that automating maintenance records to allocate costs to different types of vehicles was his highest priority (higher than service planning). A manager in another smaller operation wanted to have an automated system that could be used to evaluate mechanic performance.

A common set of needs appears to exist across types and sizes of agencies. Differences tend to emerge based on previous experience with automation and the managers' attitude toward it. Although it cannot be claimed that a representative sample was identified, it appears that smaller agencies often have more freedom to proceed with those ideas that have a strong likelihood of improving efficiency. Larger agencies tend to be more structured and decisions are not always based on functional needs. This is often because of competing bureaucratic interests or because a board of directors (or similar supervisory group) perceived nontechnical or political goals as being more important than functional goals. For example, one agency was about to automate a large number of service planning functions when its directors decided on nontechnical (even somewhat emotional) grounds that "computers weren't needed."

If one or more persons in a small or medium-sized agency can make a convincing case for new methods, needs tend to be defined at a much more detailed level. It was observed that managers in less complex organizations tend to think out more thoroughly which functional needs could be met by computers. There may well be a correlation between smaller organizations and younger, more computer-literate people being in management positions. The following summary of discussions with managers in smaller agencies illustrates these points.

1. Automation should be applied to maintenance problems. For example, an accurate real-time answer to inventory could save a substantial amount of time

for the staff and mechanics. If the inventory list is also tagged with a minimum quantity number, this information can be flashed on a daily basis so that ordering would be facilitated.

2. In addition to improved data handling, there should be procedures for analyzing the marginal costs and revenues associated with various service options (e.g., routing, fare, headways). An information management system should contain functions so that the levels of service for an entire corridor can be managed in a timely fashion.

3. In addition to handling large amounts of data, it would be useful to match automatically evaluation criteria (for a route, bus, and so on) and the data that are collected on ridership, revenues, vehicles, and so on. A means of merging data from various sources in the agency would also be important.

4. Section 15 data should be used more carefully and extensively. In conjunction with these data and other types within the agency, there should be a mechanism to integrate demographic and economic data into more automated evaluations.

5. It should be possible to plot patterns of ridership over a range of temporal frames by routes--although it does not seem necessary to have sophisticated graphics to accomplish this.

What is essential or needed is still being defined. Some agencies have a set of functional needs that appear clearly related to daily operations (getting the buses on the street). Others have

begun to reevaluate needs, spurred on by recent advances in computer technologies related to mini- and microcomputers. Still other agencies have begun to consider how to restructure their current organization of informational resources as a result of this survey. If the reactions of those transit operators contacted are indicative of trends in the industry, the OPS Program has been and will continue to be well received. To the extent that improved decision making and increased productivity are desired goals, automated tools will be implemented with increasing speed.

ACKNOWLEDGMENT

REFERENCE

1. M. Couture, R. Albright, and R. Waksman. A Preliminary Analysis of the Requirements for Transit Operations Planning Systems. Transportation System Center, TSC Staff Study 24-U-3-159, Cambridge, Mass., 1978.

Abridgment

Perceptions of Who Benefits From Public Transit

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Developing a cost-sharing program for public transit has been identified as one of the most critical issues in the transportation field today. Ideally the cost burden of public transit should be distributed among users and different tiers of government according to the share of total benefits each receives. Measuring, much less distributing, the full range of benefits, however, is almost impossible to carry out with any degree of precision. On the whole, empirical evidence suggests that the benefits of transit have been fairly modest, accruing primarily to users who live in large urban areas. The provision of improved mobility to the needy, relief of congestion, and improved land uses are the primary social benefits. Other benefits are of secondary importance. In the absence of suitable empirical data, knowledgeable state and local transit officials were surveyed to determine who benefits from transit services. There appeared to be a strong consensus that roughly one-half of the total benefits accrue directly to users, one-quarter to local residents in general, and the remaining one-quarter evenly to constituents of state governments and the federal government. This pro-rata distribution matches current expenditure patterns fairly well; however, there appears to be a common belief that the role of the user in sharing costs should be expanded somewhat and the role of governments should be contracted. This is quite consistent with current fiscal policy. Ultimately, however, any decision on transit cost-sharing must be political, keeping in mind what is currently known about transit benefits.

The fiscal plight of public transit sharply calls into question what the role of the transit user versus that of local, state, and federal governments should be in financing services. Because of the growing pressures to contain public spending and improve efficiency at all levels of government, the issue of cost-sharing can be expected to gain greater attention during the 1980s.

Most economists would argue that the cost burden of public transit should be spread among users and institutions based on the portion of benefits each receives. Measuring the full range of benefits, much less distributing them, is exceedingly difficult; thus this principle can rarely be practical in any precise manner. Rather, the ultimate decision on how transit expenses should be shared necessarily becomes a political one.

Examined in this paper are perceptions of the distribution of transit benefits and how this information might be used to develop a cost-sharing rationale. In the absence of suitable data for quantifying transit benefits in monetary terms, the perceptions of knowledgeable transit officials are used as a second-best strategy.

TRANSIT BENEFITS

A considerable number of benefits have come to be associated with public transit. The most obvious benefit, of course, accrues directly to users in the form of mobility, appropriately referred to as a user benefit. Other benefits enjoyed by all urban residents are often referred to as social benefits. Evidence on the social benefits of transit is summarized in the following sections.