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THE CHOICE OF INFORMATION FOR DECISION
MAKING IN THE TRANSPORT SECTOR

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THE CHOICE OF INFORMATION FOR DECISION MAKING IN THE TRANSPORT SECTOR

Among all the sectors of a modern industrial economy, none is more important than the transport sector. Without transportation, most other economic activities would soon cease to function, and the economy would revert to subsistence level. Consequently, although the transport sector by itself cannot insure that economic development will take place, its contributions to the development process are so important that they constitute one of the primary concerns of governments at all levels. These concerns are not limited to transport infrastructure and services administered directly by the government, but extend to all transport functions in private hands that provide public services, which are invariably subjected to at least some degree of government intervention in recognition of their importance to the national economy.

Government concern for the transport sector results in government decisions that affect the sector. It is not possible to generalize about the way in which such decision making is organized, because the kind and degree of intervention varies widely. Some aspects that in one country are strictly in government hands, in another are left to private enterprise but with strict government controls, while in a third they are subject only to governmental guidelines. Even in the latter case, however, decisions made by public agencies associated with the transport sector have a fundamental effect on the national economy as a whole.

Decision making may be defined as the choosing, from among a number of alternative possible courses of action, of a particular course to follow. 1/ Choice of the alternative that can best be expected to bring about a desirable objective makes the decision rational. When an established procedure exists for evaluating alternatives in the light of all available information to determine

1/ If there are no alternatives, there is no decision to make.

that which is best, this procedure --together with the decision itself-- constitutes a decision making process. It must be assumed that the goal of any such process is the making of rational decisions, since otherwise the choice might just as well be left to chance. Thus it can be inferred that, because determination of the best course depends on being able to evaluate the probable consequences of each one, the basis for rational decision making is adequate, timely and accurate information.

Decision making by public agencies in the transport sector traditionally has tended to be handicapped because information produced by the sector has not been well adapted to the objectives of any particular decision making process. Especially in the case of statistical information, collection, processing and distribution are often determined according to preconceived ideas about the need for a standard set of statistics, without due consideration of any special information called for by the individual circumstances in which a given decision must be taken. Decision making processes then must be adjusted to fit the information available, which is an inversion of the proper relationship.

This is not to say that a standard set of statistics should not be generated. Experience has shown that certain types of information are generally useful. The International Civil Aviation Organization uses this justification for its statistical series, for example. Experience also has demonstrated the convenience of collecting the same statistics that other countries collect to permit the evaluation of results of different approaches to common problems. It is evident that all uses of statistics cannot be identified beforehand and that many of these uses are not of such a nature as to warrant the introduction of special programs of data collection. Therefore, it is important that certain generally useful statistics about the transport sector be maintained for these purposes. The danger lies in assuming that general usefulness automatically implies sufficiency, when in reality statistics of this kind may be quite inadequate for making certain types of decisions.

/Lack of

Lack of awareness about the sometimes special needs for information in the decision making process seems to derive partly from the fact that the process is seldom analyzed systematically. Information tends to be taken for granted, which in practice means that information inputs may well be limited to those that are already available or those that are easily obtainable using procedures commonly followed elsewhere. This in turn leads to decision making processes being designed around the information available, with the consequence that the decisions themselves may be distorted because the questions calling for decisions cannot be properly phrased for lack of knowledge about them.

At the same time, the producers of information frequently do not have a clear understanding of how and by whom their product will be used. They produce what they have been taught to produce, in the form they have been taught to produce it. Or they follow example and produce what others produce. Their backgrounds in transport statistics usually have been obtained either from manuals or courses sponsored by international organizations, which emphasize the most widely used types of statistics in the most common presentations. This criticism is not meant to castigate statisticians. It merely points up a situation in which, on the one hand, producers of information generate a product whose use is ill defined, and on the other hand, decision makers accept the information available to them without prior analysis of their needs.

/Information identification

Information identification and review

In modern terms, information is understood to be a fundamental input to the decision making process. Once the objectives of a process are clearly laid out and verified, the information requirements needed to further them can be determined. These requirements in turn can be translated into a specific information plan that should include identification of the sources and procedures for information collection, and the institutional arrangements and methodologies for information processing.

All information plans should be reviewed periodically to make sure that their elements continue to reflect current needs. To be thorough, the review should commence with a redefinition of information needs in relation to any changes in objectives or procedures. This redefinition will tend to reveal adjustments that should be made in ways that data are gathered and treated in order for them to be genuinely responsive to the requirements of the process. It also will tend to reveal cases where information is no longer necessary.

Obviously, this sort of review entails more thought and effort than simply continuing to produce the same information without modification. Implementation of a change may also be burdensome. Any attempt to modify an administrative procedure is almost certain to be faced with tremendous resistance, especially when those doing the work have been at the same job for years. Overcoming this resistance requires the full understanding and cooperation of the highest executive levels in the organization, plus an amount of effort that may at times seem disproportionate to the magnitude of the change. Nonetheless, the value of instituting the change is likely in the end to be well worth the effort.

A further difficulty encountered in the institution of change is that flows of data from source through processor to user are

/usually not

usually not carried out in isolation. Data from one source may be distributed to many users, and one processor may receive many kinds of data from many sources and channel the results to many users. Introducing a change at the instance of one user might result in unacceptable changes to the information destined for other users. Thus the review procedure must include provision for the discussion of proposed changes with data producers and processors, and for feedback from them regarding the feasibility of carrying out these proposals. Then, after a certain amount of iteration, it should be possible to arrive at a reasonable solution that will improve the information going to one user without prejudicing that going to others.

All this is admittedly not a simple task. Yet it does not seem utopian to propose that an attempt be made to set up the sort of objective-oriented information identification and review procedures suggested here. Perhaps the single most important concept that must be grasped by all concerned is that information collection, processing and dissemination are all services. They are not intrinsically worthwhile in themselves; their only justification for being carried out is to supply information required for some purpose --in particular, decision making. If decision making processes are to be improved as part of an overall effort to achieve economic and social development, adequate, timely and accurate information is indispensable. Consequently, the institution of rational information identification and review procedures is of great importance in achieving the goals of development.

/An identification

An identification and review procedure

It is not believed that any generalized identification and review procedure can be applied in a given situation without undergoing some modifications --perhaps of major proportions-- to adapt it to the particular circumstances in which it must operate. Nonetheless, it is useful to outline the steps that almost any such procedure should include.

The first step is to identify the logically related set of objectives that determine the need for a decision making process to exist. It is unlikely that there will be only one objective per process, since decisions are seldom completely independent. For the same reason, it may be difficult to decide where one process ends and another begins. It may not be strictly necessary to isolate one process from another if it appears easier to treat them as a continuum, but isolation does tend to make analyses of the processes easier to handle. Therefore, even at the expense of being arbitrary, it seems desirable to distinguish a concise set of objectives in furtherance of which a decision making process exists or is to be established.

The next step is to analyze the specific decisions that must result from the process. At this point, it may become evident that some decisions in one process are so closely related to decisions in another that a redefinition of processes is in order. Even though it is advantageous to separate one process from another for purposes of analysis, it is necessary to retain sufficient flexibility so that decisions can be regrouped when subsequent analysis indicates that the original grouping was faulty. This is an iterative procedure: grouping, analysis, regrouping and reanalysis, until objectives and decisions are clearly defined.

Up to this point, information requirements have not been studied. The main proposition of the identification and review procedure being set forth here is that information needs are

/dependent on

dependent on the objectives of a decision making process, and hence cannot be identified until those objectives have been defined.

Once the objectives are understood, information needs must be established. In the ideal situation, those items of information that exactly fulfill the requirements of the decision making process would be readily obtainable. In practice, however, there are bound to be limitations on the degree to which information can be gathered and processed without consideration of physical possibility or cost. Some information cannot be obtained at all. Other information may be obtained only at a cost in excess of its value. Thus the ideal requirements must be studied in relation to the feasibility of satisfying them, to decide whether other less costly information can be substituted.

Information requirements are seldom absolute. More often than not, some way can be found to use one item of information in place of another without jeopardizing the objectives of the decision making process. In order to know what substitutions are feasible, it is necessary to identify the probable sources and processors of the required information and secure their participation in the analysis of alternatives. They can indicate where certain items that already are being processed can reasonably be substituted for some items in the ideal list. If presently available information is not directly usable, they can determine whether a modification in processing will make it so, or whether new information must be sought at the source. Hence the choice of information, like the analysis of objectives and decisions, is an iterative procedure in which the final decision is reached through a series of propositions and counterpropositions made by all groups having a direct interest in the information. Among these groups, the following three should almost always be represented:

1. The using department or agency, which is responsible for the decision making process and is generally also responsible for defining and managing information inputs to the process.

/2. The

2. The department or agency responsible for supplying the original data, which must determine if they are or can be made available, and at what cost.
3. The department or agency responsible for transforming raw data into information usable for planning and decision-making, which must provide technical opinions concerning the feasibility and costs of processing. In many instances, processing may be handled directly by either the user or the data supplier, but with the increasing application of electronic computers to data processing, this function tends more and more to be handled by a specialized department.

Practical applications

CEPAL's Transport and Communications Division, in a joint project with the Latin American Association of Railways and the World Bank, has recently begun to apply some of the concepts described here as part of a study of railway information systems being carried out in Argentina, Bolivia, Chile and Mexico. Although the focus of this study is primarily on the information systems of the participating railways, and not on the decision making processes they support, the methodology developed for the study is directly applicable to a review of information inputs for decision making. Indeed, a study of existing movements of information from producer through processor to user is a logical first step toward any improvement of information inputs.

The methodology of this study is simple, both in concept and in realization. Its principal features are two diagrams --the information input/output/user table, and the administrative relations matrix-- that permit the investigator to grasp the system's structure almost at a glance. The information input/output/user table identifies what basic data are input to the system, how these data are combined to produce each item of output information, and who receives what output from the system (which from the user's point of view indicates what inputs to his decision making process the system provides). As can be seen in figure 1, the table is quite easy to construct, but it is evident that no modification to an information system can ignore these relations without the risk of causing unexpected difficulties somewhere in the system.

/Figure 1

Figure 1

MODEL INFORMATION INPUT/OUTPUT/USER TABLE

	<u>Output listings</u>			
	Origin/destination matrix, by product	Wagon kilometers, by type of wagon	Ton kilometers, by product	Revenue, by product and station
<u>Input data</u>				
SOURCE: Freight waybill				
Origin station	x	x	x	x
Destination station	x	x	x	
Product transported	x		x	x
Weight of product			x	
Freight charged				x
SOURCE: Conductor's report				
Type of wagon		x		
Route followed		x		
<u>Users</u>				
Traction Department	x	x		
Transportation Department	x		x	
Commercial Department	x	x	x	x
Finance Department				x

/The administrative

The administrative relations matrix shown in figure 2 is significantly more complex than the table. The vertical axis identifies the specific tasks of data collection, processing and information dissemination. The horizontal axis consists of an organization diagram of all administrative units that participate in these tasks. The intersections of rows with columns contain symbols that indicate the capacity in which each unit participates, whether in performance of the task, in support of the task, in a supervisory capacity or the like.

If this methodology is applied in an analysis focused on the information inputs to a decision making process, it is evident that all the interrelations among the sources, processors and users of the information will be revealed. It will then be possible to propose modifications to present information inputs that will at least benefit the process being analyzed without jeopardizing other users, and may benefit the others as well. It must be emphasized, however, that a complete rationalization of the process cannot be obtained without previously having taken the first two steps in the review procedure: identification of the objectives that determine the need for a decision making process to exist, and analysis of the specific decisions that must result from the process. In the words of a recent report on technical assistance, "It is possible to offer a range of very efficient services without realizing that the basic fault lies in the composition of that range. The task of a competent management consists not only of improving the quality of the services offered but also of constantly determining whether those services are appropriate. It is not enough to carry out a function well: it is much more important to carry out the appropriate function." ^{2/} Only after determining what the decision making process should be doing will it be possible to insure that its information requirements are being adequately met.

^{2/} Latin American Association of Railways and United Nations Economic Commission for Latin America, "An Appraisal of the Technical Assistance Received by the Railways of Latin America", (E/CEPAL/1019, October 1976).

Figure 2

MODEL ADMINISTRATIVE RELATIONS MATRIX

Symbols

- Task performance
- Task support
- Direct supervision
- Indirect supervision
- △ Coordination
- ◇ Decision

Organization diagram

Transportation Department						Information Systems Department	
Division Freight Agent			Division Train Master			Data Entry Unit	
Station Master		Waybill clerk	Inspector	Conductor	Keypunch	Computer operations	Users
1. Data collection							
1.1 Fill out forms							
Waybill	■	□	○				
Conductor's report			■	□	○		
1.2 Collect and dispatch	■	○					
2. Data processing							
2.1 Enter data					□	○	
2.2 Validate data					●		○
2.3 Process data							○
2.4 Distribute listings							○
3. Information use							○

Tasks

1. Data collection
 - 1.1 Fill out forms
 - Waybill
 - Conductor's report
 - 1.2 Collect and dispatch
2. Data processing
 - 2.1 Enter data
 - 2.2 Validate data
 - 2.3 Process data
 - 2.4 Distribute listings
3. Information use



