Management information systems in local public transport

by

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INTRODUCTION

Until the early sixties public transport was seen as an economic activity (for a considerable part carried out by private companies) and mostly run at a normal profit.

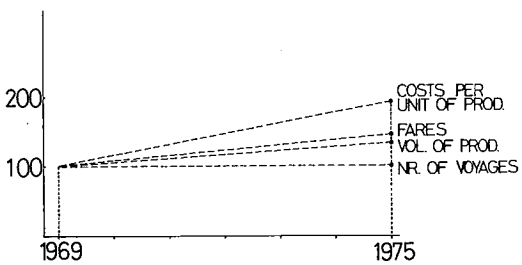
The fast growing popularity of the private car resulted in a sharp decline of the demand for public transport and huge deficits in operations.

At the same time it was acknowledged that the massive use of private cars had many negative aspects and that public transport could be an alternative to the use of the private car.

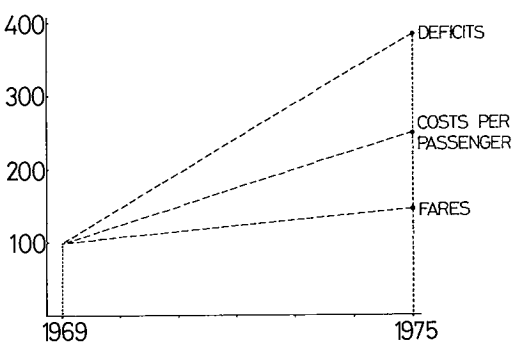
This has led to a policy of stimulating public transport and subsidizing its deficits, and as a consequence the central government in Holland now pays the integral decifits of public transport, in which local public transport plays an important part.

At the time when these fundamental decisions were made hardly anybody could foresee that those deficits would grow as tremendously as they did and at such a pace.

In the past decade the deficits in local transport had a growth rate of 20% per annum.



Scheme 1a



Scheme 1b

The direct causes of these fast growing deficits are mainly the following facts:

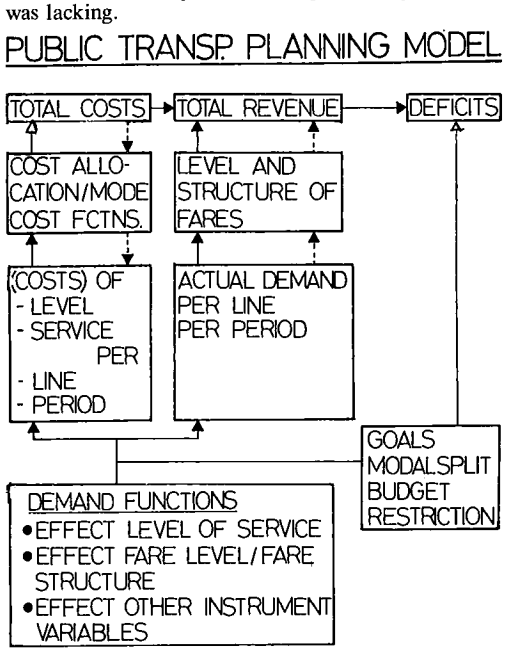
1. at a constant demand level the production of public transport has substantially been stepped up.
2. the fares the public has to pay hardly follow the increase of the cost of living.
3. the costs per output unit increased more rapidly than the cost of living index.

The deeper cause, however, was that the cost vs. revenue conception was abandoned. In fact, no other operational criteria were available for determining the:

- volume and quantity of services to be offered
- fares to be charged
- the cost level to be maintained

There were ample incidental studies on demand functions, however, with lessening attention to the actual demand. And there are a number of studies on cost models based on overall figures and cross-section analyses, but with little or no crities on the actual cost level.

Actually, a set of operational goals and an institutional framework to set up and control goals and performance was lacking.



Different authorities were involved with different aspects of public transport. But even when this instrumental framework would be available, the instruments needed were not. This situation is not typical for local public transport, nor for Holland.

MODEL PHILOSOPHY

It may seem rather simple to define the ends and the tasks of public transport starting from a set of basic goals in the sphere of the modal split wanted and the budget to be put forward. This budget should be included in the basic decisions because it is competing with other social demands. Starting with these basic goals and a demand function, a level of service, fare rate and fare structure and the actual demand can be determined.

Cost functions, fare rates and fare structure give the total costs and the total revenues, from which the total deficits can be derived.

These total deficits can be confronted with the budget, and through a number of iterations an operational set of ends and tasks can be defined.

In practice, however, things are not that simple. The actual situation is that total costs and total revenues as well as deficits are (ex post) given data.

Furthermore, there is a level of service based on historical facts, incidental decisions etc.

The link between total costs and this level of service in the form of causal relations, however, is missing.

On the demand side mostly incidental information is available, but the total demand on the network, the relation between the demand on the different lines, as well as the use of the different types of tickets are not available.

Therefore it is necessary, before going into the model's philosophy, to chart the actual state of affairs and to get a grip on that state of affairs. This is a tremendous job, which includes the overall organization, organization on the different levels involved, and the setting up of an overall information system as well as a management information system at company level.

This paper will confine itself to some aspects of the management information system at company level. This system has been developed by the EBW (Economic Bureau for Road and Water Transport) in co-operation with nine local transport companies and initiated by the Netherlands Ministry of Transport.

TASKS OF THE MANAGEMENT INFORMATION SYSTEM

The basic philosophy of this system is that the overall policy and control are in the hands of the central government, which fixes:

- the total services to be rendered per city/town
- the fare level per city/town
- the budget per city/town

The details of level of service and fares should – in accordance with the general outlines agreed upon – be decided by the local government, and the execution by the transport company.

This means that starting with a detailed information system on company level, the information on local level is considerably less detailed, whereas the information for the central government can be an overall information, but should be consistent with the management information and open to verification by an external controler.

This management information system has the following tasks:

1) It should provide a cost accounting system that gives the causal link between initial costs and final activities on the line network.

2) It should provide a task-setting budget for the company in costs, physical input and physical output.

3) It should provide a registration system in the financial sphere as well as in the physical sphere to control reality against budget.

4) The registration system should be integrated as much as possible with the process management. This not only to save costs but primarily to ensure the registration of the right data.

In many companies – also private companies – there exist for the same subject (in this instance on km-production) more than one registration system on different places, for different purposes and with different answers.

These should be replaced by one registration, made on the spot where decisions are made and accesible to all who need the information.

5) The cost accounting system should be reversable in the sense that it gives the link between the level of service and the costs in the opposite direction (cost model).

The stress on the notion of costs, cost allocation, and cost in relation to output may seem overdone. Nevertheless, it is essential because analyses of costs differences among the companies involved and between these companies and regional bus companies show differences in cost level of units of tens of percents.

Moreover, the companies involved were run in the past as civil agencies (with monopoly) rather than as companies, and the traditional accounting systems in these companies were primarily set up to respond to income and expenditures and not to control efficiency.

BASIC FORM OF THE COST TYPE/AND COST CENTRE SYSTEM

The centre of the system is a conventional cost type/cost centre system of which the principal construction is shown in scheme 2.

In this scheme three basic types of centres are distinguished.

General and additional cost centres

This type of cost centre renders services that either cannot be measured in performance units (for instance general management) or of which the performances are fixed during a period (for instance housing and garaging). These costs are charged to other centres on the basis of keys, defined in advance.

Production centres

The performance of these centres is measurable, and variable in total volume as well as in the distribution over other centres.

The costs of these centres can be calculated in an amount per unit of performance and charged to other centres according to the volume of services delivered.

Last production centres

These are the production centres of which the performances are directly charged to the final activities on performance basis. Prominent last production centres are:

- rolling stock
- driving personel
- infrastructure

The costs of these last production centres are charged to the final activities as shown in scheme 3.

Accountability per department

Based on the organisation of the company and the production process, the individual cost centres are defined in such a way that they form alone or in conjunction a center accountability.

This grouping into centres of accountability is necessary in order to put forward task-setting budgets.

The task-setting budget for the company as a whole can be subdivided in tasks per department, per subdepartment and on a lower level by task per individual

COST TYPE / COST CENTRE SCHEME

TYPE OF COSTS	COST CENTRES			FINAL ACTIVITIES
	GENERAL + ADDITIONAL COST CTRS.	PRODUCTION CENTRES	LAST PRODUCTION CENTRES	
WAGES				
CHARGING VIA	KEYS	STANDARD COSTS X VOLUME OF PERFORMANCES	STANDARD COSTS X VOLUME OF PERFMNCS.	

Scheme 2

NUMBER OF		COSTS PER	
VEHICLES	X	VEHICLES/YEAR	= f .....
VEHICLE-DAYS	X	VEHICLE/DAY	= f .....
VEHICLE-KMS	X	VEHICLE/KM	= f .....
DRIVING-HOURS	X	DRIVING-HOUR	= f .....
KM INFRASTRUCTURE	X	KM INFRASTRUCTURE	= f .....
DIRECT COSTS OF INFRASTRUCTURE			= f .....

Scheme 3

1. TECHNICAL DEPARTMENT

2.

GENERAL	BUS	TRAM	INFRA-STRUCTURE

3.

GENERAL BUS	REPAIR-SHOP A	REPAIR-SHOP B

4.

GENERAL REPAIR-SHOP A	SUB DEPMNT. 1	SUB DEPMNT. 2	SUB DEPMNT. 3

Scheme 4

centre of accountability, as shown in scheme 4.

By use of the computer this grouping and subgrouping is easy to achieve.

Charging of costs between cost centres

A problem in a cost centre model is that not only centre A charges to centre B, but that also the reverse situation exists.

With the help of a system of equations this problem is solved by computer routine that gives, in one calculation process, the equilibrium equation.

The results give in matrix form and per cost centre, the centres to which it charges its costs and the amounts charged, as well as the centre that charges costs to this cost centre.

Prices and quantities

The initial cost amount per cost centre consists of a price, a physical quantity and an amount. Per cost centre these three elements are stated.

In the same way the charges from other cost centres are split up in quantity price and amount. From general cost centres the quantity consists of a percentage, whereas from productive centres the quantity consists of the amount of performance delivered.

COSTS CENTRES REPAIR BUSES

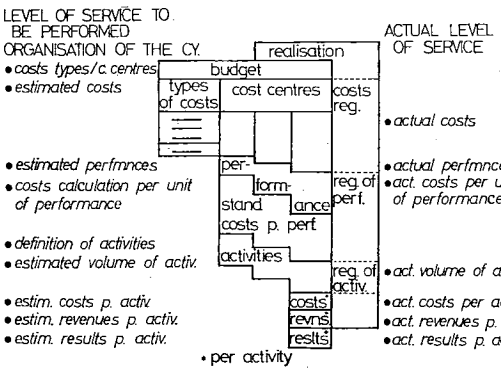
COST TYPE / COST CENTRE	UNIT	QUANTITY	PRICE	AMOUNT x *f* 1000	%
		COSTS CHARGED TO THE CENTRE			
A. *INITIAL COSTS*					
wages	nr. of mechanics	65	30.000	1.800	35
social charges	Wage-sum in *fl.*	1.800.000	0,50	900	18
other initial costs	—	—	—	200	4
sub-total initial costs				*2.900*	*57*
B. CHARGES FROM OTHER CENTRES					
housing	m^3	10.000	50	500	10
overhead of the department*)	% of total overhead dept.	100	1.500.000	1.500	29
charges from centres	—	—	—	200	4
sub-total charges other centres				*2.200*	*43*
TOTAL COSTS	NR. OF EFF. HRS.	100.000	51	5.100	100
		COSTS CHARGED TO THE CENTRE			
C. *CHARGES TO OTHER CENTRES*					
bus-park	nr. of effective hrs.	70.000	51	3.570	70
investment account	nr. of effective hrs.	15.000	51	765	15
housing	nr. of effective hrs.	5.000	51	255	5
other cost centres	nr. of effective hrs.	10.000	51	510	10
TOTAL CHARGES	NR. OF EFF. HRS.	100.000	51	5.100	100

*) General overhead not included.

Scheme 5

This makes it possible, to calculate per computer the effects, in case of price changes or changes in quantity, and to present the new budget.

An example of the budget for a cost centre/centre of accountabillity is shown in scheme 5. In this way a cost allocation system integrated with a tasksetting budgeting system is set up per company.



Scheme 6

Evaluation

The system described gives the causal relation between costs and performances, without, however, giving nominal costs.

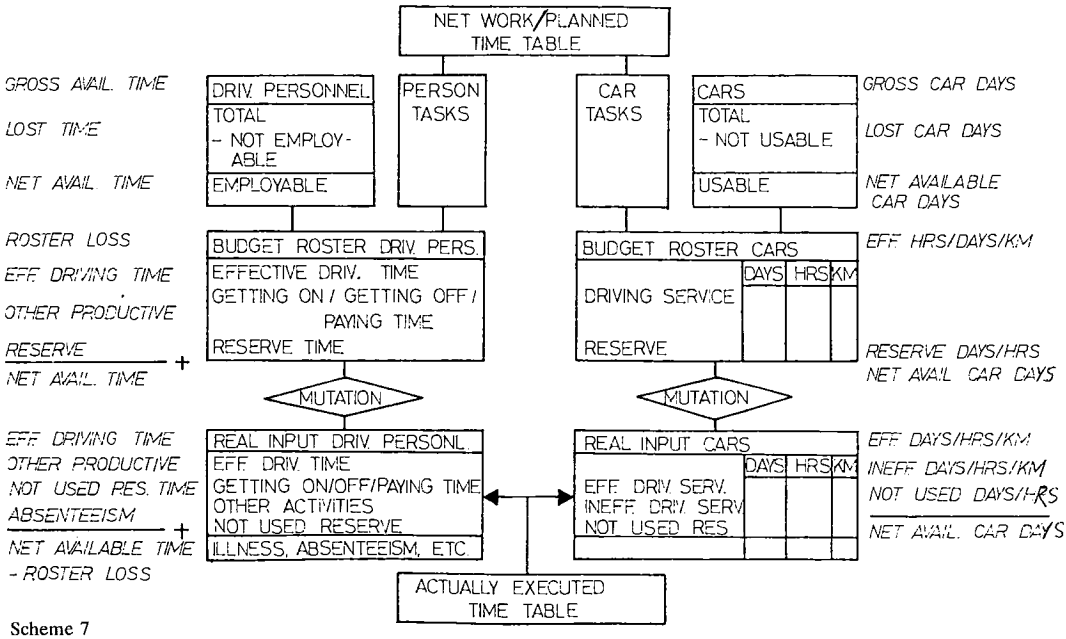
Critical evaluation and intercompany comparison based on uniform accounting systems give the possibility for critical review and can show ways for improvement.

Very important in this sphere is the composition of the tariff per performance for the production centres.

wages costs incl. social changes direct personel per nominal hour _____
cost of non production time _____
cost of indirect production time _____
cost per direct productive hour of direct personel _____
costs of indirect personel per direct hour _____
additional costs per direct hour (housing, inventory, etc.) _____
total costs per direct production hour _____

Cost models

Reversing this cost allocation model from output to input leads to cost functions, that for instance give the



Scheme 7

relation between changes in output and change in input, and the cost effects of changes in organisation of the production process.

Registration systems

A budgeting system as described earlier only has meaning when the actual course of affairs is registered according to scheme 6).

Within this registration system three main groups can be distinguished:

1) The financial registration including the registration of quantities at the initial costs.
2) Registration of the times of direct personel
   - drivers
   - mechanics
3) Registration of the use of the rolling-stock.

Financial registration

The financial registration should – whenever detailed – conform with the cost type/cost centre system.

Per item is stated:

a) the cost type
b) the cost centre to be charged
c) the activity to be charged.

The activity is introduced mainly for purposes of controls in the technical department. The technicians want to know not only the costs of repairs and maintenance per 100 km, but also the costs per type of maintenance. This is solved by a seperate grouping of costs per type of activity.

The registration of time of direct personel and of rolling stock

Driving personel and rolling-stock

In public transport the most complicated registration is that of the performances of drivers and rolling-stock.

As in this sector most of the performances are planned and realisation is highly in accordance with the planning, the registration of what really is performed need not to be done in detail.

On the contrary, the planning is translated in planned performances and only the deviations from the planning are registered. The principle of this registration system can be found in scheme 7.

The level of service is translated in person tasks and car tasks. These tasks are confronted with the available driving personel and the available rolling-stock. From these data the planned performance is registered. The deviations are put into this planned performance and this automatically gives the actual performance.

The composition of the tasks as to effective driving time, indirect time, reserve time, etc. is not gathered in one stage.

Information on the lines (for instance km per line) is automatically linked to the standard car tasks, whereas the car tasks are linked to a high degree to the person tasks. Information on the drivers is linked via a code number to the tasks to be performed.

As these parts of the planning are fixed to a high degree, the planned performance and its details can be calculated with a few variable data.

With the help of a computer program in which the detailed planning is stored and deviation from planning are brought in, the real use of time of driving personel and of rolling-stock is calculated.

The results of these calculations are printed out in comparison with the planning in a series of tables for different viewpoints.

Experience in Amsterdam with this system showed that the extra costs of this procedure were moderate in comparison with the cost of previous non integrated detail registrations. Combination of this system with process management (for instance planning, scheduling of tasks, salary administration) which is for a large part realized, can even bring forward cost savings and can prevent errors caused by the manyfold rewriting of the same data.

Of course the real value of the system lies in the close control of the realisation that makes sharper planning possible. Marginal savings in the number of driving personel outweigh the cost of the system. In combination

with the rest of the total M.I.S. in which the demand pattern is included, the possibilities of this system can be fully used.

Registration of mechanic time use

As to the time use of mechanics no detailed planning forward planning exists and this registration is set up as an integral observation of time used. As far as effective direct time is concerned, a notification is made of the type of activity and the car or car series for which the activity is carried out.

In practically all companies, this type of registration (more or less in detail) is available. The problems in this field are, who writes the time used and to what degree of exactness can this be done.

The new element is that the time used is combined with standard costs per hour and directly translated into costs.