

Systems to manage the efficiency of public transport of people through indicators and respective values of good practice

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Abstract: *Statistical analyzes of the commercial efficiency of different public transport lines of a network draw attention to significant dispersions. The transport technology (subway, tram, bus), served territory (center / periphery, serving of objectives) itineraries, network connections, service levels are the ones that generate significant differences in the commercial efficiency of lines within the same network.*

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Introduction

Although the term performance is now commonly used in the transport sector, this concept has very different meanings. Assimilated to efficiency, the concept most often refers to the quality / cost ratio that integrates the efficacy (socioeconomic) rather than efficiency.

1. Functions and performance indicators

At government levels, public policies target a number of performance indicators based on specific objectives / tasks.

Three categories of indicators stand out:

- **Socio-economic efficacy indicators** that measure beneficial public policies for the citizen (citizen's point of view);
- **Service quality indicators** that aim to improve the user experience (user's point of view);
- **Efficiency indicators** aimed at optimizing the means / resources used in relation to the effects produced.

Performance analysis of a public transport network differs from the one of other public services on at least two plans:

- on the one hand, the performance of the public transport service not only depends on **the quality of the service** offered during the journey but also on the **accessibility** of the various urban facilities (jobs, services, study, commerce, recreation);
- on the other hand, the performance of the public transport service is integrated into a global body of a **mobility system**, defined by a set of infrastructures, ways (walking, cycling, personal motorcycle, motorcycle) and related services, including placement offers.

It results in the fact that the performance of public transport must take into account three areas:

- a. Public transport system (infrastructure, means of transport, offered technology / services);
- b. The mobility system, i.e. all mobility needs in a territory and the available offers;
- c. The urban system (the urban shape and structure that give it its specificity in operation).

Each one involves a variable number of actors involved.

In terms of users, public transport service functions and performance indicators in Table 1 can be highlighted.

Table no.1. Service functions and performance indicators of public transport

Functions of the public transport	Performance indicators of public transport
I. Citizens' accessibility to the territory for: labor, trade, health, school, recreation, etc. (Through an adjusted service offer)	1. Spatial access (covering the territory with public transport lines)
	2. Temporal access (frequency adapted to demand, minimum frequency of regular

	service, frequency at time peaks of demand)
	3. Intermodality (ensuring continuity and stability of the movement)
II. Transportation available to all citizens	4. Ensuring access for people with reduced mobility
	5. Facilitating access for people in precarious situations
III. Reducing individual motorized travel by increasing the attractiveness of public transport	6. Information on timetable, schedule compliance, improving comfort (in the means of transport and in the waiting areas)
	7. Ensuring continuity of service (incidents, strikes)
IV. Relations (communication, receptivity) with citizens	8. Ensuring the functional reliability of the network
	9. Recording and taking into account suggestions and complaints
	10. Transparent management and adapted to mobility applications
V. Contributing to the quality of the environment by limiting negative externalities	11. Dynamics of local and global environmental damage levels
VI. Ensuring economically acceptable operation for users and for the community	12. Ensure the integrity of the public transport system patrimony
	13. Ensuring financial support for the service (distribution of sources of revenue and expenditure for the maintenance of operation)
	14. Ensuring a good quality / global (social) cost ratio

Source: Authors own contributions

There is a number of 6 functions and a set of 14 main indicators.

The last of the indicators, "Ensuring a good quality / global (social) cost ratio", is a synthesis indicator, designed on a multi-criteria basis, to give an overview of network performance that allows dynamic examinations and comparisons with the performance of other networks. If such a system of indicators is in line with the objectives of actions to manage a public transport system, then we must note that it is slightly able to explain the results obtained and to indicate the sources of efficiency or inefficiency of the network. In other words, it is suitable for managerial needs and too comprehensive to explain performance.

2. Productive efficiency and commercial efficiency

Productive efficiency is a structural objective for the enterprise undertaking the exploitation because it directly depends on the results of the activity. But, equally, the organizing authority is interested in any customer who buys a service. The standards imposed by the organizing authority have a direct consequence on the amount of means mobilized by the transport operator (energy and human resources). Many service-specific constraints make it impossible to optimize the production process as in the case of industrial production: intermediate stocks can not be made (production is instantaneous and localized), production levels can not be changed over time (daily, weekly, yearly) without undertaking major socio-economic offers, it is not possible to make a smooth evolution of the traffic conditions (speed, regularity, etc.). Certain conditions imposed as supply standards (amplitude, frequency, comfort) mean an oversize of the mobilized productive resources with a direct effect on costs.

In conclusion, optimization under constraints is difficult and most often requires marginal adjustments to the organizational authority's specifications and actions on traffic conditions (in particular by prioritizing). On the other hand, research on commercial efficiency reveals different issues within public policy.

Referring to the performance of the network and the extent to which it is used (number of passengers in relation to vehicles x km made), we are inevitably able to adjust the supply to the volume of demand. Obviously, it is easy to understand that the solution consists in suppressing low-used services (in times when demand is small) or limiting services in less dense areas (in particular peripherals) but any of these contradict the objectives of a sustainable mobility (because this attitude is not likely to reduce the share of cars in meeting mobility needs).

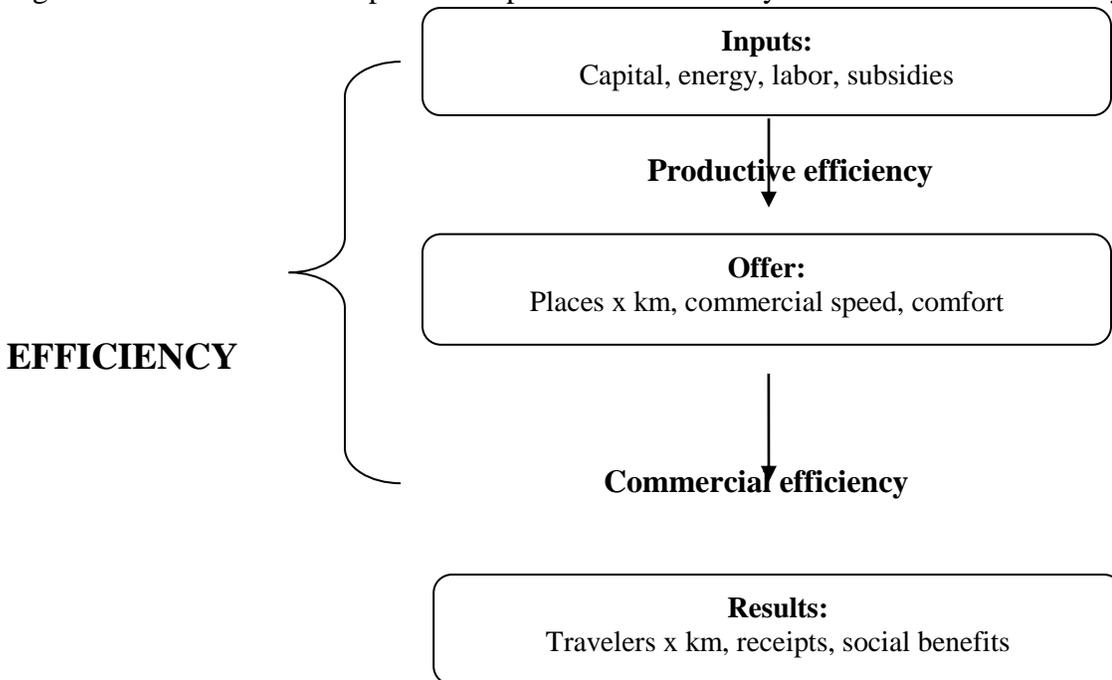
The interest in studying commercial efficiency does not lie in its absolute value, but in its relative values. These are the means to identify weak lines or sub-assemblies of the network that has low performance in

order to investigate causes and identify actions that can improve performance. The causes may be of a structural nature (inadequacy of the type of service at the level of demand) or of the nature of a gap between the offered service and the expectations of the targeted customer (a too low frequency, too long time compared with competing modes). In such cases, a more in-depth analysis of the increasingly diverse customer needs is required. The theoretical considerations suggest that the contractual relationship between the organizing authority and operators should provide incentive clauses and that „financial contribution rate” (the net costs incurred) which establishes a separation of industrial risk (operating costs) and trade risk (trade revenues) must provide for a better adapted form.

It is therefore appropriate (in a difficult financial context for the collectivities) to reflect on the contractual mechanisms in favor of optimizing the network. For example, through performance clauses, the operator has a greater margin of maneuver to allow the offer to be adjusted to actual service constraints.

As suggested indirectly by Figure no. 1, a global efficiency measure could be the average cost for a traveler.

Figure no. 1. The relationship between productive efficiency and commercial efficiency



Source: Baumstark et al., 2005

Some organizing authorities regularly publish the cost to the traveler, which, among other things, allows to assess the impact on the tariff system (Faivre d'Arcier, B., 2010).

3. Conclusion

The set of information and analyzes presented is a basis for a useful management tool in the research for increasing the performance of urban public transport, more precisely useful for comparing the results of (productive and commercial) efficiency of a line with the ones of another of the same type or with the ones of medium lines of the same type of network. In order to simplify the picture, we will retain a limited number of indicators specific for supply, for mobility needs and for public policy objectives. As we have already said, we do not intend to provide a detailed diagnosis of the performance of a public transport line but to provide criteria for positioning a line in relation to others and to highlight the weak or high performance elements of the line.

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