INTEGRATION IN URBAN MOBILITY SYSTEMS: QUALITY UPGRADING OR COMPETITION BLOCKADE?

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Abtract

Along the years most European countries considered urban public transport as a social need, which was a determinant factor for the regulatory and organizational setting of transport markets. However, evidence exists across the world that the provision of a social service does not necessarily involve adopting a specific market or industrial organization. In particular if economic efficiency and quality of service are aimed at, other tools have to be developed. In Urban Mobility Systems integration is one of such instruments, mainly due to the need to establish goals that are compatible with those of other policies (e.g. environmental, land-use), and to provide adequate answers to stakeholders needs and aspirations. The definition of the strategic objectives of the system is one of the main building blocks of the Urban Mobility System and observation of several European cases leads to the conclusion that quality performance of services provided by such a system will depend on the concerted action between different elements of the system. This paper addresses urban mobility as an integrated service and presents the main costs, benefits and barriers that should be considered to achieve this wider level of integration, while discussing the effective potential of this instrument to hinder competition in the current evolving organizational and regulatory environments in Europe.

Keywords: Integration; Urban mobility systems
Topic area: C1 Integrated Planning of Transport Systems

1. Introduction

The definition of an Urban Mobility policy is a complex issue since it is very much related with the specific characteristics of the local environment and with the respective political priorities, which may change between localities within the same country, and even between neighbor communities served by the same mobility system. The former being herewith defined as the set of different transport means and modes supporting mobility needs, in a determined spatial area, best represented by the summing up of different experiences of regulatory and organizational models and even of ownership and mission of the various entities providing mobility services.

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European policies aiming at an improved efficiency and effectiveness of the transport system are carefully pushing the revision of the regulatory and organizational settings of this sector (revision of regulation 1191/69), through the introduction of competitive pressure in public service contract awarding, while challenging old established monopolies to re-organize themselves. In parallel to this some of the main agents of this process (authorities and operators) decided to start their changing process focusing on the regulatory and organizational situation in their cities (MARETOPE, 2002).

Evolution of the structure and dimension of the urban environment itself, added to the congestion phenomenon, the scarcity of public money and, last but not least, a growing awareness of society about environmental problems, are among the factors leading to stronger demands of efficiency and effectiveness of mobility systems. All these movements of change justify the need to rethink public service concepts and to consider that no single mode is able to satisfy citizens' requirements. Furthermore, some decades ago subsidies for public transport found considerable political support, while today these services are confronted with severe state budget constraints, encompassed by the eventually equivalent importance of other services of general interest and a better informed and more demanding set of clients.

Several sciences have been called upon to study different angles of this complex problem, and no doubt that valuable results have been achieved in several fields. Good examples are pricing policies, new market access regulation, socio-economic studies to better define market segments and willingness to use public transport, contractual incentives for service provision, and so forth. Quality management was no exception, and a few operating companies looked at certification, as a marketing tool to drive them out of the crisis, while others went even further by adopting Total Quality Management models. Despite all these efforts, so far only marginal improvements were obtained in the performance of the companies that have introduced these processes and management models, which in turn have proved to be successful management tools in other sectors. Moreover, none of these developments solved the main problems faced by the urban mobility systems during the recent years, namely:

- congestion and financing problems are becoming more and more acute;
- citizens' needs are not being adequately satisfied with the current dichotomisation of supply between UPT and private car and complaints are raised everywhere;
- the dichotomy private versus public transport does not allow to understand the real needs of the citizens and is leading the system towards a decreasing tendency of UPT market share, which is not being reverted;

Changes in urban configuration, as referred above, have been often pointed out as a major cause of these problems, with an increasing residential dispersion, longer home-work distances and consequently more complex mobility demand patterns. In conjunction with this, an increasing availability of private motorized transport is a common trend almost everywhere, largely boosted by a more commercial approach from credit institutions that facilitate car acquisition. As urban space is a limited resource, the more number of private cars circulating inside the cities the lower is the global level of accessibility (measured in travel time) for all the population. Consequently, the quality in terms of travel time and frequencies that public transport undertakings are able to offer decreases in a direct relation with this global level of accessibility.

The last years have also witnessed in a number of European countries significant changes in the legal and organizational frameworks of local public transport in order to ensure an improvement in transparency, economic efficiency and quality of the service. As already said the European Commission promotes this development through the provision of an appropriate legal

framework at European level, as originally suggested in the Citizens' Network Green Paper and later reinforced and clearly indicated in the Communication "Developing the Citizens Network". However, it should be made clear that whatever regulatory regime is in force, its success strongly depends on the effectiveness of the relationship between authorities and operators. That is, one of the main functional roles of authorities is to induce operators to conduct their business towards the achievement of the strategic goals of the system (i.e. principal-agent theory), for which complementary contractual schemes of incentives and penalties are an indispensable tool.

All these developments confirm the importance of the efficiency concept, both in production and consumption (i.e. efficiency from the users viewpoint), of local transport systems as one of the main building blocks for sustainable growth and employment opportunities in Europe. The diversity of variables involved in the formulation of the problems certainly causes a wide diversity of approaches to Urban Mobility, reflected in the definition of the system configuration. However, dealing with UPT and improving its fitness to local society needs requires undertaking a more holistic view of the context under which these services are defined and operated – i.e the Urban Mobility System (UMS).

Previous work developed (Macário R., 2000) concludes that for the Urban Mobility System to achieve a quality level that provides and appropriate and effective answer to the needs of its clients (individual and collective, i.e. the society) three different, yet complementary, quality dimensions are required:

- Quality of the service provided, and;
- Quality of the different organizations involved in the definition and production of the services for which certification processes and TQM approach are within the most used tools, and
- Quality of the overall UMS system, where a number of policy and institutional integration aspects have to be conceived, implemented and monitored in order to ensure the system is steered is such a way to contemplate aims and aspirations of individual stakeholders and society in general;

This paper deals with the last dimension and with one of the main instruments to achieve quality – that is, wide scope integration. Herewith quality is assumed with a dual interpretation. In one hand, as a harmonizing factor for the autonomous behavior of individuals and organizations, as required by modern societies and, in another hand, as the driver of a symbiotic process where a renewed concept of co-ordination without support of hierarchies should be developed based on institutional and policy interaction, where operational performance outcomes are assessed against the strategically defined objectives.

2. Structure of the urban mobility systems

This complex institutional environment that forms Urban Mobility Systems can be disaggregated into three levels of planning and control [ISOTOPE, 1997], or decision levels, being:

- The strategic level, where the mobility policy, objectives and means, are defined reflecting the needs of the citizens and the local political priorities. The decision process being usually performed by political entities;
- The tactical level, where the mobility system is conceived and the respective policies are defined translating the strategic goals into operational specifications, assuring the effectiveness and coherence of the system. Depending on several parameters the functions that this level entails can be performed by different agents and contracts can also be allocated through competitive procedures;

- The operational level, where transport services are produced and consumed. Depending on the regulatory option, public transport services can be performed directly by the transport authority, in which case it accumulates also the design of the system, or contracted out to an operator (private or public) or a planning company, by direct negotiation or through a tendering procedure. It is worth referring that the individual self-productive modes and all the infrastructures are an integral part of the mobility system.

In the real world the division into these three levels is not so clear as described above. For most European cities (urban areas or conurbations served by the same transport system) the boundaries between these levels are very often fuzzy and the overlap between the strategic and tactical levels is common, with less clear (or even non-existent) strategic options made. The lack of a clear and well-structured regulatory and organizational framework is a determinant factor that may hinder the successful definition and implementation of a coherent mobility system, in particular if an effective interaction between the different parts of the system is not properly assured.

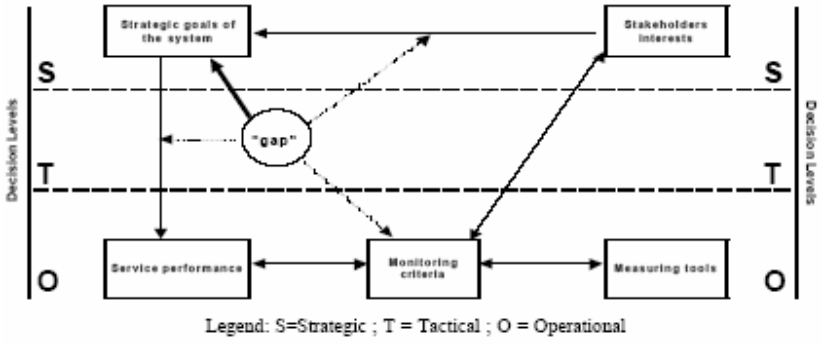

Figure 1: Decision Levels

The definition of objectives, and guidelines on political priorities, is a function within the strategic level of the mobility system. A consensual strategic goal is to achieve a configuration for the mobility system able to address concerns at the following dimensions, originally defined by Ciuffini (1995), and herewith adapted:

- Transport dimension – adequate balance between modes and means of transport, so that all those that give up the use of private car have available alternatives of good quality, without any sort of social, geographical or sectorial discrimination;
- Environmental dimension – the configuration of the urban mobility system should result in a total sum of pollution below the endurance level;
- Economic dimension – the system should offer good "value for money", induce an adaptive behavior from the users, and be able to create new financial resources to support investment;
- Social dimension – the system should assure citizens are provided with a transport system adequate to their needs and that no exclusion through price, or any other criteria, will be imposed on base of economic or financial goals.

Trade-offs between these four domains are conditioned to the socio-economic and cultural reality of each specific environment (urban area or conurbation), and also to the political options that result from the interaction between the local, regional and national levels of intervention. It is thus a function of the strategic level to assure a definition of objectives that provides an adequate answer to the UMS stakeholders requirements, considering the existence of two categories of

interests, being: the ones represented by the personalities of individual stakeholders, and; the ones of the society, traditionally represented through the public service and welfare concepts.

But the essential characteristic of a system is the interaction of its parts. Consequently the individual improvement in the performance of its components taken separately, although necessary, does not assure the overall improvement of its performance. A determinant factor of this performance is how well the different parts of the system will fít together, which is directly related with the interaction between the main enablers and processes identified in the different structural decision levels of the urban mobility system. That is, control through co-ordination - herewith understood as concerted decision making, since very often there are no hierarchical dependencies between interacting organizations - is required in all decision levels, based on existing interlinkages and their impact in the way trans-organizational processes (i.e. processes managed across different intervening organizations or agents) have to be managed both in a steady state regime and under a changing environment.

These dynamic interaction mechanisms affects both organizations (or agents) and urban policies, and it is this dynamic characteristic that enables system flexibility to adapt no new demand patterns, creativity to conceive new services in order to increase patronage and, consequently, organizational change to adapt agents to the evolving environment, while keeping congruence and consistency in their working methods, processes and organizational models.

Mobility is thus a network system where fitness of each agent is determined by the good adjustments and consistency between the actions of the different agents, as Lindblom said "*Within the set, each decision-maker is in such a relation to each other decision-maker that unless he deliberately avoids doing so (which may or may not be possible), he interferes with or contributes to the goal achievement of each other decision-maker, either by direct impact or through a chain of effects that reach any given decision-maker only through effects on others*"[1]

This symbiotic stage of interdependence forces the mobility system to have structural consistency and this entails a horizontal and a vertical dimension. Horizontally consistency is given through the equifinality of action between the different agents – mobility providers acting at different moments and with different roles in the supply chain. Vertical consistency is achieved by way of three attributes: coherence, efficiency and accountability

Coherence is given by the alignment of decoupled objectives down through the different decision levels assuring that the objectives settled at the strategic level will be well derived into adequate goals for the tactical and operational levels. Efficiency represents the capacity to best transfer the basic resources (that is the means that were allocated through strategic decision, assuring thus financial autonomy) into service outcomes, assuring this property at the tactical level, and further down into consumption units, revealing then the efficient performance also at the operational level. At last, accountability constitutes a main instrument for management control, which enables a feedback loop between field results and strategic decisions.

The cross effects between horizontal and vertical specialization in a mobility system leads to a complex network of institutions with different degrees and forms of interaction, but all should be linked by three elements: a chain of consistent quality performance objectives; a set of regulations framing institutional behavior; a control mechanism based on feed-back informational flows regarding system monitoring and assuring accountability of all institutions involved.

Given this tight net of interactions, fitness of purpose and action is important, even a truly indispensable attribute that can only be assured by a continuous adjustment of institutional design to policy and regulatory changes, that can be materialized in changes in goals, instruments or

[1] Lindblom C.E., (1965), "The intelligence of Democracy", New York, Free Press, pp21-22

settings. In addition, the more the levels of government and diversity of agents involved the higher the concertation costs, as well as the complexity of the task, to assure consistency and coherence of action.

3. Need for customer orientated system design

The design of the transport system, with the articulation of the different modal sub-networks to create an integrated urban network, is within the main functions performed at the tactical level. Its non-existence results in an urban transport system characterized by bilateral agreements formalized between operators, seeking the maximization of their own profit, and without offering a network that effectively provides economies of scale and scope for the users, in particular, and for the local society in general.

The form of organization at the tactical level is strongly determined by five main variables, three of them are internal to the mobility system itself and two others, despite being external to that system, have a strong influence in its organizational structure. These are:

- Internal variables:
  - Legal possibility of having a plurality of initiatives on the market (i.e. degrees of freedom) and entrepreneurship for those initiatives (i.e. who takes the initiative);
  - Degree of competitive pressure and incentives in the system;
  - Level of technical competence of the interacting agents for planning complex networks;
- External variable:
  - Political-administrative organization of the country/region.
  - Regulation externally imposed (valid for European Union only).

Within the domain of the internal parameters, the main division is between regimes where the operator takes the initiative and the ones where the initiative of creation of transport services is left to the authorities.

The main advantage of the first ones, also known as market initiative regimes, is the fact that they enable an active participation of the operator in the service design, providing the stimulus for the improvement of the service and consequently a stronger willingness to share the planning and revenue risks with the authorities. The revenue risk is mostly related to patronage and fares, and the former is highly influenced by the quality and appropriateness of the service to the customers needs, reason why the involvement of the operator to the design of the services is so important.

Within this entrepreneurial classification we can find two different regulatory regimes according to the degree of competitive pressure present in the system: the deregulated regime (free competition) and the licensing, also known as authorization regime (limited competition). The former provides a good example of the main disadvantage of market initiative systems, which is the reduced, or even non-existing, network integration and coordination with the consequent lack of quality of the transport system. Whenever the initiative of creation of services lies freely and exclusively with the operator, this is done according to his own commercial and economic interest, giving priority to cost efficiency objectives. In limited competition systems the authority can mitigate this drawback by subjecting the granting of the license, or authorization to explore, to the compliance of specific requirements regarding system integration (e.g. physical, logical and tariff integration (Viegas and Macário, 1998b)).

Where the creation of the services is left to the authorities, that is authority initiative systems, the compliance with requirements established in accordance with the strategic goals can be, at least theoretically, more easily achieved, and enforcement should be a lower cost function than in

other regimes. The main advantage of these systems is that they give structural priority to integration and stability of supply, while seeking cost efficiency through other instruments.

The figure bellow illustrates the variety of existing regulatory systems according to entrepreneurship and degree of competitive pressure that were identified in the ISOTOPE research and recently re-confirmed on MARETOPE research.

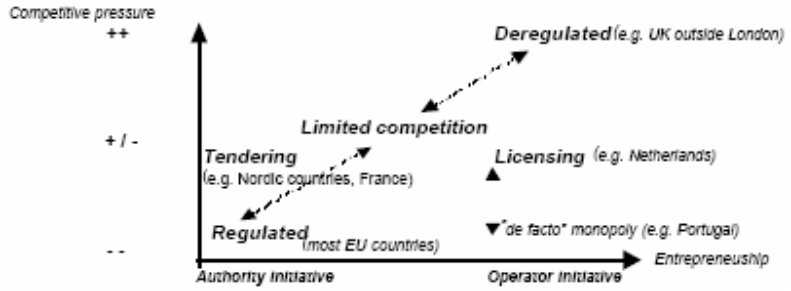

Figure 2: Classification of legal and regulatory regimes in Europe

In what concerns the external variables influencing the tactic organization of the mobility system, the political and administrative organization of the country is also a determinant factor. A number of different solutions have been implemented across Europe and worldwide and there is strong evidence that the trend has been to replicate the political-administrative division of the countries (i.e. national, regional and local division) into the organizational framework of the transport system. The distribution of the public budget has been clearly one of the main pragmatic reasons to match fiscal and financial autonomies with the organizational responsibilities.

Nowadays - as the size and shape of urban areas has developed and spread across suburban areas forcing the transport network configuration to loose its original radial shape and to extend beyond the administrative borders of the city -the need to extend the scope of intervention of the transport authority to all communities with a direct stake in the mobility system is more evident. However, though the reasoning behind the functional enlargement of the scope of intervention can be clearly understood from the perspective of mobility needs, the same cannot be said from the respective financial autonomies of those organizing authorities. This is an important constraint factor to set pricing and financing policies for the transport system, and consequently for the specification of the services offered.

In addition to these aspects, another external variable is the regulatory constraints that will be imposed soon by the European Commission, which despite leaving many degrees of freedom for local decision on financing and contracts awarding, are nevertheless another factor binding the local decision-makers.

The regulatory and organizational framework acts as an umbrella under which transport services are designed, planned and produced. The definition of transparent rules for the allocation of responsibilities and sharing of risks between the different agents of the system is thus an indispensable tool for the management of the Urban Mobility Systems. Operators from different modes and authorities from different jurisdictional levels have to coexist both in time and in space. Moreover, transport authorities have to devise together with authorities from other areas common strategic goals for the same urban area if congestion relief and environmental protection is to be achieved.

Evidence exists in several cities around the world, that the balance between private and public means of mobility can only be achieved through the application of co-ordinated “pull” and

"push" measures, the former entailing the improvement of the quality of public transport facilities and the later aiming to restrict the use of individual transport in certain areas and periods.

The success of pricing and financing schemes in Urban Transport Systems is also strongly dependent on the regulatory and organizational framework of the system (FISCUS, 1998), and in its potential to facilitate concerted decisions between the different policies with impact in mobility demand patterns (e.g. land-use, environment, etc.), as well as between the push and pull measures developed by different agents of the system - authorities and operators.

It is often forgotten that one of the remote causes of the external costs caused by transport is the location of the economic and social activities, that is, urban economics, which are at the outset of the generation of mobility needs. It should be noted that in the beginning of the last century mobility was mostly organized on radial design basis to serve monocentric metropolitan areas while today modern cities became more and more polycentric with employment centers already spreading to suburban areas.

Moreover, it is also the role of the transport pricing policy to contribute to the control of the external costs produced by the system, caused mostly by the need to use motorized mobility, and this can only be achieved by the combined use of market based incentives together with control regulations. The former should persuade users to adapt their behavior towards the policy aims, while the latter are mostly meant to restraint practices leading to the growth of external costs.

A quality management approach to the urban mobility system implies thus an increased focus on individual customer needs, which can only be done through the separate analysis of the market segments, best described as homogeneous segments with differentiated preferences, which requirements can be satisfied through market orientated services.

Determination of customer needs and aspirations is the start of the process, after which the translation of those needs by the organization responsible for system design must be secured. Two major challenges are present here: firstly to obtain from those clients a perception of good quality when services are received, and secondly to set a process of systematic assessment leading to the so called continuous improvement, eventually with redesign of services, that will guarantee their long-standing loyalty.

It is still worth referring that urban mobility systems have specific characteristics that make quality implementation more difficult: firstly, as all other services, production and consumption occur simultaneously and the services are intangible; additionally, the production of services for several transport modes is made in an environment (the public urban space) in which a chain of multiple agents interact on a time and space sharing basis, without having any of them in full control of the system.

These characteristics have contributed for a growing gap (see figure 1 and 2) between the stated political goals of the system and the results achieved at the operational level, thereby leading in one hand to a degradation of the terms of competition of public transport versus the private car, and in other to the awareness that there is a general insatisfaction of the citizens towards the alternatives offered by the system. This clearly shows that a successful urban mobility system should go beyond the old dichotomy of public transport versus private car, through the creation of innovative intermediary services

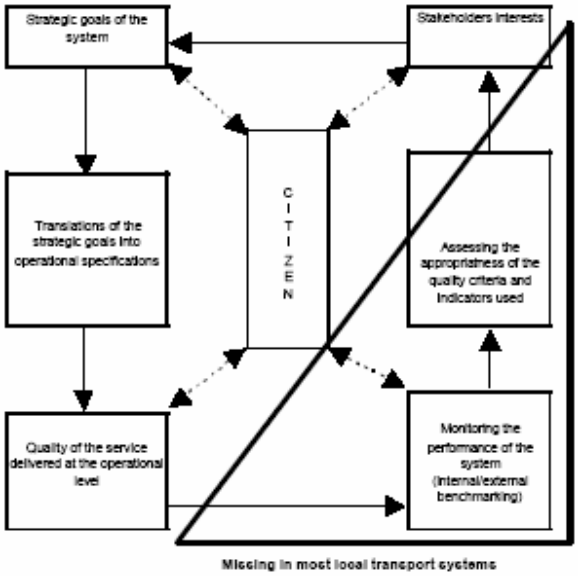

Figure 3: Conceptual dynamics of a quality approach to UMS

For some time integration is being promoted across European cities. However, it should be made clear that integration calls for a systemic approach to mobility, but market segmentation goes one step further, calling for a symbiotic relationship between modes and services, where intermediate services will help to cover the needs and preferences of the different market segments. These intermediate services largely correspond to dedicated tailored services, which use can still be done on collective basis, although on smaller group dimensions than the one of the current public transport, providing a perception of a more personalized service.

The range of possible complementary services is very wide and represents a privileged domain for operators to apply their innovative potential, without forgetting the "mass" business characteristic of public transport leading to increased unit cost the more market segmentation is done. Indeed, this raises the issue of a second level of integration in the mobility system (Viegas and Macário, 1999):

- The first level should be directed at the basic mobility needs. It corresponds to the general integration between public transport services and it should be basically defined by the authority and directed at the regular public transport operators. The objective of this first level is to comply with public service obligation and also to the minimum standards as defined by authorities;
- The second level should be directed at the more sophisticated requirements of mobility. It corresponds to the "upgrade" of the basic package to higher requests of mobility, and is managed on a commercial basis by transport operators or even service providers in the domain of "urban passenger logistics" (possibly without a single vehicle of their own), who basically build partial agreements of specific service integration;

The role of the transport authority in the second integration domain is to allow it and ensure that its existence does not distort the terms of its own contractual engagements with public transport operators, namely in the sense that no public subsidy money is deviated into this activity. Moreover, it is for the authorities to supervise operating conditions related with technical proficiency and safety of operations, even if these occur under fully deregulated market access regime.

4. Integrated services and interchanges : attraction or cost factors ?

As already noticed the development of cities is usually accompanied of increased complexity in mobility needs, which is largely caused by the multifunctional way of living in current societies. This evolution of the logistic organization of our societies places new demands on the mobility system requiring it to fulfill a number of attributes, such as:

- Good levels of spatial, temporal and economic accessibility;
- Reliability of the services offered;
- Organization of services in such a way that enables the user to achieve economies of scale and scope in its consumption.

The limitations of each mode associated with a scarce urban space calls for the need to develop mobility networks based on service complementarity and compatibility, that is a synergetic approach to the mobility system, where each mode has the mission to serve specific markets needs. Within this structured network the several modes and services will feed each other allowing different perceived configurations for the possibilities of service chain (or service mix), according to the different intensities of demand (peak, off-peak, night services, week-ends, etc), with public transport playing a determinant role as main mass transportation option.

A key factor for the success of this integrated approach is that clients must perceive this option as an effective complementary alternative to the individual motorized mobility as well as to other intermediate collective services. To compete with the attributes of the latter public transport should be seen as an equally available, easy to use, flexible, comfortable and with low perceived costs, that is offering a good relation between quality and price (the so called good "value for money").

The easiness of use has its operational translation made through the simplification of an originally complex product, that requires the ability to manage considerable amounts of information, such as knowledge of timetables, routes, connections, etc. So to achieve this goal urban public transport needs to offer[2]:

- Good information on the available options;
- Coverage of the operations of all modes and operators, allowing the user to perceive the network as a whole;
- Possibility of offering tailored information limiting the complexity and amount of information to the minimum required to satisfy user needs;
- From any point of the network understand the possible connections to all other services and modes available in the network.
- Stability of perception of service (long validity periods for timetables);
- Network integration, the above referred structured interrelatedness of services enabling:
- Easiness to change route;
- Easiness to use different operators in the same trip;
- Availability of interchanges to enhance fluidity of transfer flows between modes and services;
- Schedule co-ordination and minimization of transfer times;
- Fare integration for both frequent and occasional users.

Under this framework integration is an instrument to improve quality of the services and with it increase public transports market shares and reduce traffic congestion. It is also consensual that integration, when existing also at the tactical level, enables to obtain additional advantages on cost efficiency for the whole system since it contributes to avoid duplication of service whenever

[2] Morrison A., 1996, pp 256 - 260; Viegas J. et al, 1998b, pp 3-5

no added value exists for the client. Consequently, intermodality should not be considered as an objective in itself but instead as a determinant factor to achieve system integration.

The meaning of concepts such as intermodality and especially of integration can differ substantially in the views of the different stakeholders involved in public and private transport. This divergence can even be greater if we talk about optimum levels of integration and the operational meaning of this expression. From the theoretical viewpoint in an overview of the literature[3] related to integration we could find little development beyond the descriptive cases, however it was possible to identify four main theoretical perspectives that can be used for the analysis of this issue, being:

- The engineering perspective on integration, based either on evidence of what is perceived to be a good practice or on efficient use of resources;
- The economic perspective based on market failure and suggesting interventions aiming to achieve welfare optimization;
- The public management (policy orientated) perspective based on institutional frameworks and focused on behavior of actors; and
- The more recent, institutional or evolutionary economics, driven by the institutions and their evolution.

In its productive perspective of efficient use of resources the engineering approach often establishes the optimum with a strong focus in elements such as fleet management, vehicle and staff roster and planning of service bundling, without considering the effects of the interaction on agents behavior and the potential for emergence of "optimized" configurations of integration out of market dynamics.

A main weakness of this approach is the reduced focus on the cost-revenue balance and the implicit assumption that the solutions accruing from resource optimization correspond to a good reading of passengers perception of quality of services as an answer to their needs. Under this approach service definition and integration tends to be done under rather rigid parameters and not as a reaction to the behavior of demand. Another limitation is the fact that it does not consider the effects of incentives to integration. So, under this approach integration is largely established through an optimal mix of different public transport services/modes having each service characterized through the hard aspects of service design, such as speed, frequency and distance between stops, and giving a second priority to the soft elements as perceived by the client, such as vehicle comfort, service convenience, information, fares, etc.

The economics perspective is essentially focused on market functioning and takes as departure base the functioning of markets under the implicit assumption that deregulation leading to perfect competition will contribute for optimal efficiency outcomes. Suppliers of services are seen as agents pursuing their own selfish objectives of profit maximization but it is the market through the interaction of several competitors (in an open market environment) that enables an "automatic control" of any disruptive behavior. The only reason for the non-achievement of the superior aim of welfare maximization is market failure. Market failures can originate from different sources such as:

- Existence of externalities (that is value effects which are not absorbed by the market pricing mechanism);
- Existence of economies of scale and the correspondent development of natural monopolies;

[3] Based on the study on "Integration and Regulatory Structures in Urban Public Transport" produced for the European Comission in 2003 by the consortium NEA (NL), TIS.PT (PT), ISIS (IT), Oxford University (UK), Erasmus University (NL) and OGM (BE), pp 18-38

- Existence of asymmetric information between participants;
- Existence of public goods, defined as goods where consumption are not in rivalries and are non-excludable which is not the case for public transport;
- Economies of scope, better known as network effects which are fundamental for the analysis of integration in mobility services and which are largely under researched in public transport, at the opposite to what happens in air transport, although this knowledge can not be directly transferable given the difference of complexity between these two realities of services/modes.
- Finally, regulatory or governmental failures, in particular through the externalities caused by non-efficient allocation of subsidies (e.g. X-inefficiencies)

According to the findings of some authors (e.g. Economides N. (1996) and Shy O. (2002)), a main reason for the appearance of network externalities is the complementarity between components of the network, that is arcs and nodes which in a mobility system are respectively represented by the services provided and by the intermodal interchanges. To this we must add a compatibility attribute, indispensable to achieve service complementarity, which means in practical terms feasibility of integration in a strict sense.

In urban mobility systems the concept of compatibility of integration is more gradual than in other networks, as the interchange between sub-networks of the mobility system is always possible. But for the user that possibility effectively exists as a function of the associated costs of transfer. Relevant elements of this cost, and consequently also relevant for potential compatibility, are the information costs on complementary services, costs associated to ticketing acquisition, opportunity costs (or disutility, i.e. cost of time) of the excess time spent in transfer as a lack of synchronization between services, etc.

In practical terms, the concept of network effect is materialized in the quality improvement achieved through the reduction of the generalised cost of the network user, as the number of transfer increases and consequently the number of service options. This improvement can thus be achieved either through the addition of more services to the main network or through the creation of intermediary services that will enable the consolidation of the net tissue and which normally have also a demand complementary to the one of the core network.

Indeed, this direct network effect, which occurs as a consequence of the complementarity between main and intermediary services, results largely from the fact that improvement in one segment leads to an increase in the demand of the segments used in combination with the first. This effect provides evidence on the clear benefit accruing from the use of intermediary services as feeders of the main services, which is a common practice in South America where these services have emerged from market initiative (although illegal at the start) in a natural mechanism of detection of opportunities and commercial risk taking. However, we should not ignore that for the operator the cost-benefit balance resulting from service compatibility depends on a set of factors related with the way common costs are shared and also on their dimension.
Besides the direct effects there are still the indirect one, which is the case of the Mohring effect (Mohring H., 1972) in public transport, according to which the increase in the demand of one segment will in the mid term lead to the increase of frequencies in that segment, which in turn will foster additional increases in demand as an answer to the perceived improvement of the service quality.

The public management perspective emphasizes agents' behavior highlighting barriers to implementation. Typically suggests inter-institutional approaches, however, tends to ignore the dynamic characteristics of the organizational and regulatory frameworks. Another weak point of this approach is the fact that ignores the spectrum of different possible commitments between

agents that can go from the simple partnership agreement to the synchronization of services or, even further, to the common planning.

At last, institutional economics, formulates solutions in relation to the evolutionary stage of institutions. However, it provides no input for optimization of institutional design neither for overcoming barriers to achieve system configuration leading to "optimal integrations. Another aspect that hinders the utilization of this approach is the reduced transferability of institutional configuration between cities (Macário, 2003)

In brief, each approach has its own perspective on strengths and weaknesses of integration, being mostly complementary in contributions given to understand the genesis of the integration process, which entails answering the following key questions:

- Do benefits of integration overcome the costs of the process?
  - From the different studies analyzed the engineering and economic approach allow to conclude that some forms of integration produce benefits but no indication was found on optimum levels of integration
- If there is support for the argument in favor of the existence of clear benefits of integration, why does optimal integration not appear spontaneously from the market ?
  - So far the only conclusion obtained is that the analysis of this problem should consider the principles of network economies
- How to assess the current level of integration and how to decide whether to search for more integration ?
  - Considering the rational previously presented, the definition of the appropriate level of integration is part of the "marketing mix" choices for the mobility system. However, while in a corporate business this market analysis corresponds to a continuous process of sequential phases of planning, action, check, learn and feed-back, corrective action, etc, in a mobility system this process is simultaneously undertaken by several agents (authorities and operators). Indeed, authority action is in itself a determinant factor of the "marketing mix" through service specification, which in turn influences the level of integration

5. How to assess costs and benefits of integration ?

The answer to these questions was addressed in the study undertaken for the European Commission (NEA et al, 2003)[4], however the lack of appropriated information systems unabled the complete quantification of the integration processes in different cities. Considering these constraints the analysis was done for packages of relevant integration elements, such as:

- Integrated information, so that the mobility system is perceived as a whole;
- Integrated ticketing and fares, so that intermodal trips are not penalized;
- Network integration, at the planning and operational stage;
- Wide scope integration.

The methodology used was supported by the following theoretical rational[5]:

- The point of optimal integration corresponds to the point where marginal social costs of integration are equal to marginal social costs. Consequently, it is possible to look at

[4] The following case studies were included: Hamburg, Lisbon, Longwy, Manchester, Rome, Rotterdam, Stockholm and Vienna. In addition the following cities were also observed: Paris and Ille de France, Brussels; Stuttgart; Genoa; Barcelona and Seville

[5] Full description of methodology used can be found in the reports from the study (NEA et al, 2003) and (TIS et al, 2003)

existing levels of integration and determine whether integration is suboptimal or super-optimal;
- However, this is not possible because integration is not a continuous variable. Several aspects are encompassed in this concept and an index should be constructed as a composite of all these aspects. The current lack of adequate information system unable the construction of such index;
- Alternative being the use of discrete CBA studies where costs and benefits of specific integration measures and projects are examined (the above referred packages)

A characteristic of this methodological framework was that the assessment of benefits and costs was undertaken within a "before-after" approach using only information for the area in which the integration measure was introduced and not through cross sectional information from different areas.

From the application of this method a number of problems resulted, mainly related with incorrect data, incomplete series, difficulties in allocating causality relations between variables, incompatible spatial scales, relevance of modal coverages, etc. However, despite these limitations, the analysis allowed to obtain the following results:

- There are positive impacts associated to the implementation of integration measures. In the short-term (1-2 years) annual increases in demand of around 34% could be found, and in the longer term annual increases would be less than 1%.
- Some empirical evidence of sub-optimality was found in Manchester (information, tariff and wider integration) and Rotterdam (network integration);
- No evidence was found to support the super-optimality thesis;
- Evidence was found in Stockholm and Rotterdam that integration of information can produce very significant cost reductions
- A major problem found was the fact that emerging costs and benefits are supported by different groups of incidence, suggesting the need to develop redistributive mechanisms, at least to assure all operators have identical net benefit from integration;
- Several barriers to the integration process were found that can be divided in mainly three groups: framework barriers; implementation barriers; lack of resource barriers

6. Conclusions

The complexity of mobility patterns that characterize current societies result in organized chains of unimodal trips, using nodes of transference. That is, the physical and functional representation of a network of intermodal transfer points connecting a multimodal mobility system. This means that to assure a set of attractive services, offering economies of scale for the users, the following dimensions of integration should be considered:

- The ones perceived by the clients:
    - Physical integration – in space, time and technology, reflected in network design, existence of good interchange stations, schedule co-ordination. That is intermodality strictu sensu;
    - Logical integration – entailing a global information system (all modes and all operators), possibility of tailored information, good perception of reliability of connections influenced by real time information. This represent the interface between the client and the system and also a major tool for system monitoring;
    - Tariff integration - including fares and tariff integration as well as revenue sharing.

- An underlying dimension indispensable to ensure the visible integration, that is: organizational or managerial integration entailing decision processes, allocation of clear responsibilities between different authorities (i.e., land-use, transport and environment, between transport authorities and operators (i.e. through contracts), between operators from different modes (i.e. through agreements and partnerships).

From the different studies done we can conclude that there are fundamental requirements for the successful implementation and monitoring of integration measures. These requirements can be divided into three categories:

- Within framework conditions:
  - Commitment and political priority given to integration so that the necessary means to achieve it are made available;
  - A clear allocation of integration responsibilities in the organizational framework, considering the different stages where decision and actions are needed, such as: entrepreneurship; implementation; financing; monitoring. The objective should be to improve causal relations between decision taking and quality performance of the mobility systems
  - A flexible regulatory and organizational regime so that market initiative to provide better answers to customer needs, eventually with the creation of intermediary services, comlementary and compatible, is made possible;
- Within implementation process:
  - The introduction of integration measure requires involvement of the three decision levels:
    - Strategic – how much integration do we want and what are the available means ?
    - Tactical – What type of integration is needed to achieve the defined goals?
    - Operational – Who should be responsible for which processes ?
  - Competent authorities able to effectively monitor and steer the mobility system, setting integration standards and quality objectives for the agents involved in the provision of mobility services at planning and operation stages;
  - Utilization of integration criteria in contract awarding for public service operation, keeping market freedom to initiate new services beyond the minimum established.
- Within resource management:
  - Clear rules to allocate common costs for infrastructure use;
  - Compatibility of services in the use of technologies.

Finally, no evidence was found that competition will hinder integration. Indeed, this may occur if integration is wrongly thought exclusively at operational level, instead of being envisaged from the strategic level down to the tactical and only at the last stage in the operational field.

We conclude that integration is not an objective in itself but instead should be seen as an organizational process through which the different elements of the mobility systems are conducted into a closer, and more efficient, interaction, resulting in overall improvement of the quality of the mobility system

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