INSTITUTIONAL FRAMEWORK AND PERFORMANCE OF MOBILITY SYSTEMS: A REVIEW OF FUNDING AND FINANCING IN PUBLIC TRANSPORT SYSTEMS

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ABSTRACT

The crucial importance of institutional design in the evolution of mobility systems and the relevant socio-economic and environmental implications have been currently the centre of academic attention, primarily in light of the major reform wave that many mobility systems have undergone in the last decade, in order to improve efficiency, promote competitive forces, enhance quality of services and achieve sustainability. The need for institutional redesign or realignment based on renewed functions and tasks that must be translated into organizational structures and relations between authorities, operators and other stakeholders related with the provision of mobility services, is identified as one of the major cornerstones of successful change.

Performance assessment constitutes a means of evaluating if the system functions according to expectations or not and, in the urban mobility context, it involves the assessment of the system´s individual components, i.e. stakeholders, infrastructure, networks and services. Indeed, a well-implemented performance assessment framework requires a sound institutional base, while at the same time inability to achieve predefined goals and objectives implies, among others, the need for reassessment of the institutional configurations, from a structural, spatial and resources point of view. Accountability plays also an important role in inducing performance improvements and ensuring clear relationships between stakeholders.

The purpose of this paper is to provide an interdisciplinary framework that defines the spectrum of institutional setting-performance interaction, doing an in-depth reflection into public transport from an institutional, funding and financing perspective. Thus, in this paper we analyze in a structured and critical way the current situation and future challenges of

funding and financing, as well as point out crucial and potentially problematic elements that influence and are influenced by institutions and performance factors.

Keywords: Funding, Financing, Institutional Design, Performance, Reform, Barriers, Constraints, Public Transport

INTRODUCTION

Worldwide public transport systems have undergone major reform processes during the past decade, as a response to a number of conditions that resulted in the unattractiveness, inefficiency and unsustainability of transport modes. Furthermore, it was influenced by the general reform of the public utilities sector, other network industries, as well as the local authorities' reform, aiming at cost effectiveness, transparency and accountability.

The purpose of this paper is two-fold; to provide an insight of the basic principles that constitute the backbone of institutional analysis, institutional change or reform in general; and, based on the adopted framework to further focus on public transport from an institutional, funding and financing perspective, analyzing in a structured and critical way the current situation and future challenges, as well as pointing out crucial and potentially problematic elements that influence these areas.

The paper is structured in three parts: the first part addresses the institutional definitions and the constraints imposed on the processes of institutional change relating these to institutional attitude and consequent performance; the second part addresses institutional change in public transport and the barriers that hinder these processes; finally, the third part, addresses the funding and financing solutions and their relation with institutional settings and performance.

INSTITUTIONS, STRUCTURES AND PERFORMANCE

Literature overview of approaches to institutions and institutional change

Institutions have been defined in various ways (Williamson, 2000). Indeed, many scholars in the literature show different understanding of this concept, based primarily on their beliefs and background in reference with the economic theory schools that they follow. Aoki (2001) identified at least three different meanings that economists have attached to the word ''institution', which he interprets into three conceptualizations, from a game-theoretic point of view, i.e. analogizing economic process with a game. Thus, economists have regarded an institution as comparable to either player of a game, the rules of a game, or equilibrium strategies of the players in a game (ibid). The most prevailing conceptualization is the second one, with Douglas North as the most prominent representative.

North (1990) defined institutions as "the rules of the game in a society, or, the humanly devised constraints that shape human interaction. In consequence they structure incentives

in human exchange, whether political, social or economic". He also argues that there is a distinction between institutions, identified as rules of the game, and their players. Furthermore, he defines these players as organizations, i.e. "groups of individuals bound by a common purpose to achieve objectives". The fact that this approach has been adopted by a major part of the scholars might lie heavily on the fact that North´s perspective is considered to bridge old and new institutionalism[1], or, according to Mantzavinos (2006), the correspondent theory has greater empirical content. Nevertheless, North´s underlying rationale and methodology, as well as his commitment to the neoclassical theory have received some criticism (see Zouboulakis, 2004; Prasad and Tisdell, 2006).

Hurwicz (1994) focuses more on the enforcement aspect, expressing the rules of the game as a triplet, which he calls ''mechanism'' or ''game form". Thus, specifications are required so as to who plays the game, what actions players can choose (choice set) and what physical outcome corresponds to each profile of the players' choices (outcome function) (Aoki, 2001).

As far as the game equilibrium of institutions is concerned, Aoki (2001) identified two streams of thought; one that lies on the development of the evolutionary and the repeated game approaches, and another that relies on sophisticated concepts of equilibrium, such as sub-game perfect equilibrium, in repeated prisoner's dilemma games. Aligning more with the game-theoretic perspective, along the economic, social, or political domains, he defines institutions as "self-sustaining, salient patterns of social interactions, as represented by meaningful rules that every agent knows and incorporated as agents' shared beliefs about the ways how the game is to be played" (ibid).

In a similar context, Alexander (2007) defines institutional design as "the devising and realization of rules, procedures, and organizational structures that will enable and constrain behaviour and action so as to accord with held values, achieve desired objectives, accomplish set purposes or execute given tasks". By this definition, institutional design is pervasive at all levels of social deliberation and action, including legislation, policymaking, planning and program design and implementation (ibid).

Many scholars provide classifications of the institutions based on various attributes, some examples of which we provide herewith. North (1990) distinguishes between formal (sanctions, taboos, customs, traditions, and codes of conduct) and informal (constitutions, laws, property rights) institutions and their enforcement aspect; Roland (2004) classifies institutions as slowly and continuously ("slow-moving" – technology and culture, including values, beliefs and social norms) or rapidly and irregularly ("fast-moving" – political institutions) changing; Ostrom et al (1994)[2] characterize institutions based on the aim of the

[1] For more information refer to Old (or Original) Institutional Economics (OIE) and New Institutional Economics (NIE) literature. For a comparison, see, among others, Hodgson (1998), Peukert (2001) and Parada (2003). See Richter (2005) for a review of the diachronic evolution of NIE. Landry (1996) considers a greater typology of institutional approaches: Old institutionalism, Neo-institutionalism, Meso-corporatism/policy community networks, Game theory, Transaction cost theory/agency theory/theory of contract (Saleth and Dinar, 2004)

[2] See Institutional Analysis and Development (IAD) framework under the ADICO syntax which stands for five subcomponents of an institutional statement: attribute (A), deontic (D), aim (I), condition (C), and or else (O). The three types of institutional statements are created from different combinations of the ADICO syntax: Strategies

rules, classified as position, boundary, choice, aggregation, information, payoff and scope rules; Saleth and Dinar (2004)[3] characterize institutions in terms of three hierarchically related categories of rules, i.e. constitutional choice, collective choice and operational rules.

Scott (2001) argues that regulative, normative and cultural/cognitive systems constitute vital ingredients of institutions, denoting them as pillars. Thus, in this regulative-normative-cultural/cognitive context, institutions: (i) constrain and regularize behaviour (rule-setting, monitoring and sanctioning), (ii) develop normative rules that introduce a prescriptive, evaluative, and obligatory dimension into social life (values and norms), also imposing constraints on social behaviour and (iii) are primarily influenced by a socially mediate construction of a common frame of meaning (ibid), respectively. He also considers that the regulative and normative pillars can be mutually reinforcing (ibid).

Williamson (2000) provides a comprehensive contextual framework of institutional analysis, presented in Figure 1. He also follows Douglas North and New Institutional Economics in distinguishing between institutional environment (political, social, and legal ground rules of the game) and institutional arrangements (governance) (ibid).

	Level	Frequency (years)	Purpose	Theory
L1	**Emdeddedness:** *informal institutions, customs, tradition, norms, religion*	100 to 1000	Often noncalculative; spontaneous	**Social theory**
L2	**Institutional environment:** *formal rules of the game, esp. property (polity, judiciary, bureaucracy)*	10 to 100	Get the institutional environment right. *1st order economizing*	**Economics of property rights / positive political theory**
L3	**Governance:** *Play of the game, esp. contract (aligning governance structures with transactions)*	1 to 10	Get the governance structures right. *2nd order economizing*	**Transaction cost economics**
L4	**Resource allocation and employment:** *(prices and quantities; incentives alignment)*	continuous	Get the marginal conditions right. *3rd order economizing*	**Neoclassical economies / Agency theory**

Figure 1: Economics of Institutions (based on Williamson, 1996)

Although he tackles the issue from a broader perspective than usual transport-related analyses, we consider it constitutes an appropriate approach as a starting point towards analysing the institutional setting of urban public transport. Furthermore, the hierarchy and feedback elements of the system are also important since higher levels impose constrains on lower levels and lower levels ‘‘feedback’’ to higher levels to provide adaptation to (Stone, 2008). Under this approach, we position the elements of funding and financing primarily in

include only the attribute, aim, and a condition - AIC; norms include the attribute, deontic, aim, and condition - ADIC; and rules consist of the entire syntax, an attribute, deontic, aim, condition, and or else – ADICO (Ostrom et al, 1994; Crawford and Ostrom, 1995; Ostrom, 2005; Basurto et al, 2009)

[3] See Institutional Decomposition and Analysis (IDA) framework, inspired from Institutional Analysis and Development (IAD) framework (see previous footnote).

the rules of the game, governance and resource allocation levels. In relation to transportation, a great part of transportation-related authors refer primarily to the formal actors that influence the "game" and corresponds to the governance level (L3) of Williams´ framework, while the formal rules of the game (L2) are usually referred to as legal and/or regulatory environment that complements the institutional arrangement it formulates and supports.

Decision-making plays also a vital role in institutional arrangements, whilst the structure of the decision-making process (centralization, state intervention) is a strategic characteristic which can influence and, to a certain extent, impose the features of the decision making process (i.e., interest group influence, conflict resolution, knowledge and information availability etc) (Zografos et al, 2004).

In a nutshell, the prevailing theories of institutional analysis are based on the New Institutional Economics perspective, which incorporates, among others, theories of transaction cost economics, property rights, agency theory and public choice (see Figure 2). It also rejects the neoclassical concept of homo oeconomicus that acts autonomously and mechanically, detached from institutions (Topan, 2001). Moreover, opportunism and bounded rationality are the key behavioural assumptions on which transaction cost economics relies on (Williamson, 1996).

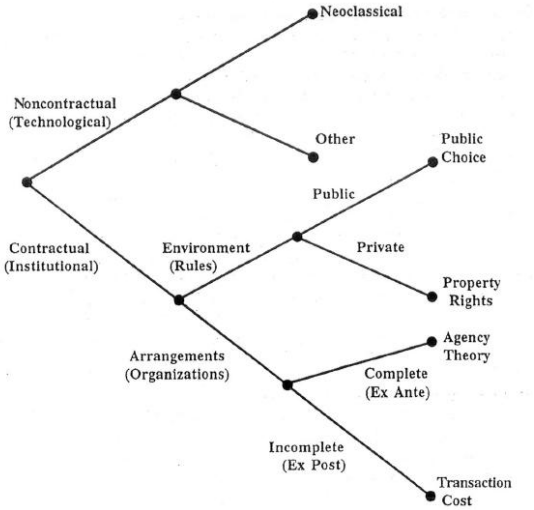

Figure 2: Economic theories of organization[4] (Williamson, 1990)

Aoki (2001) developed a comparative institutional analysis framework, arguing that the nature of institutional dependencies is captured in explicitly evolutionary game-theoretic ways, individual agents are not only constrained but also informed by institutions, and institutional evolution may be characterized by path-dependence and novelty, as well as by critical junctures and evolutionary selection (equilibrium). His analysis is based on a definition of institutions that was presented earlier in this paper, and which was developed along five

[4] According to Thompson and Green (1998), "neoclassical welfare economics provides the prototypical example of what Williamson labels technological economics because it is based on production technologies, given in production functions, and consumption technologies, given in utility functions. (...) Institutional economics is contractual in that it examines the institutions that define the relationships among various parties".

building blocks: (i) endogenicity, (ii) information compression, (iii) robustness with respect to continual environmental change and minor deviance, (iv) universality of relevance and (v) multiplicity. From an organizational architecture perspective he identified three generic modes of information connectedness among task units in an organization, i.e. hierarchical decomposition, information assimilation and information encapsulation, on the basis of complimentary or competitive tasks, as well as systemic and idiosyncratic segments of the environment.

Lane and Ersson (2000) also sustain a game theoretic approach, arguing that the distinction between institutions, on the one hand, and interests or preferences, on the other, are nested within a basic principal-agent interaction, where political leaders act as agents of their principal, the population, with institutions regulating this interaction.

Institutional stability is also an important parameter in the framework of institutional analysis. Furubotn and Richter (2000) state that an institutional equilibrium, if any, that would represent a complete institutional arrangement, would mean that an original set of formal rules remains in active use despite the fact that a supplementary set of informal rules and enforcement characteristics has emerged to complete the total structure. They also identify two states of institutional equilibrium; (i) when new informal rules evolve to reach a stable endpoint without destroying the original formal framework and (ii) after a disturbance of an initial institutional equilibrium a new equilibrium will be reached (ibid).

Furubotn and Richter (2000) also argue that the general perception on institutional change is that it results from the institutional instability derived by bad institutional design, but in reality this instability might emerge as a consequence of economic growth/decline, or even technical, intellectual and cultural shifts (ibid). North (1993) identified five propositions on institutional change:

- The continuous interaction between institutions and organizations in the economic setting of scarcity, and hence competition, is the key to institutional change.
- Competition forces organizations to continually invest in skills and knowledge to survive. The kinds of skills and knowledge individuals and their organizations acquire will shape evolving perceptions about opportunities and hence choices that will incrementally alter institutions.
- The institutional framework provides the incentives that dictate the kinds of skills and knowledge perceived to have the maximum payoff.
- Perceptions are derived from the mental constructs of the players.
- The economies of scope, complementarities, and network externalities of an institutional matrix make institutional change overwhelmingly incremental and path dependent.

Institutions and performance

The purpose of developing a performance framework is primarily the identification of the parameters that lead to a system functioning worse than anticipated, i.e. risk factors, while another aspect of performance management is the motivation of stakeholders towards better performance, through incentivization or penalization initiatives, i.e. inducement factors. Furthermore, accountability is also directly related to performance management and it is gaining more importance in the contemporary research areas as an effective inducement factor.

A great number of techniques have been used and a variety of performance metrics have been developed for purposes[5] such as reform and performance evaluation. Notwithstanding the fact that the literature in this field is really extensive, an overarching approach of performance definition from a global system performance perspective, i.e. covering both individual organization, as well as system level, requires further research.

There are many different types of evaluation tools that can be used in a variety of ways, all addressing performance measurement: ongoing monitoring and performance indicators; project and program evaluation - ex ante, ongoing/formative and ex post/summative; performance (or value-for-money) audits; financial auditing. This broad spectrum of performance measurement activities is also known by other generic labels, such as monitoring & evaluation[6].

According to Poister (2003), useful performance measures facilitate over time the actual improvement in an organization or a program, thus in order to be useful, a measurement system must be designed to serve the needs of the particular management process it is intended to support. Moreover, performance measurement systems are used to support a variety of management functions, such as monitoring and reporting, strategic planning, budgeting and financial management, program management, program evaluation, performance management, quality / process improvement, contract management, external benchmarking, communication with the public etc.

Nevertheless, distinction should be made between performance of the private and the public sector, mainly because of differences in goals and objectives. While for example, private firms aim primarily at profit maximization and efficiency-related performance frameworks,

[5] Examples of transportation-related performance metrics are: Railways Liberalisation Index by IBM (2004), production frontier model for the evaluation of reform effects of on efficiency (e.g. Friebel et al (2005)), strategic evaluation of policies (e.g. Multicriteria analysis (Vreeker and Nijkamp (2005)), policy integration (e.g. Stead and Meijers (2004)), planning quality (e.g. Carmona and Sieh (2004)), operational performance monitoring and evaluation for contract management (e.g. Lake and Ferreira (2001)) and quality management purposes (e.g. Seco and Gonçalves (2007)), as well as performance frameworks, such as e.g. Hensher's (2005) performance pyramid etc.

[6] Examples are: Performance Indicators, Benefit-Cost and Cost-Effectiveness Analysis, Logical Framework Approach, Client Satisfaction (or Service Delivery) Survey, Rapid Appraisal Methods survey (Focus group discussion, Community group interview, Direct observation, Mini-survey), Benchmarking (Carin and Good, 2004).

according to Nagel (2002), in public policy evaluation there are six sub-criteria to the overall criterion of maximizing societal benefits minus costs (3Es & 3Ps), that is (i) effectiveness, (ii) efficiency, (iii) equity , (iv) public participation, (v) predictability and (vi) procedural due process or procedural fairness.

From an institutional approach, Lane and Ersson (2000) argue that, from a regimes[7] perspective, performance configuration reveals what the characteristic policies of such composite institutions tend to be, as well as what the overall profile of the outcomes attending such policies looks like. However, performance is not a causality, firstly because factors other than institutions may be at work and secondly because these outcomes may cause institutions (ibid). For this reason they suggest that comparative institutional analysis must employ regression analysis to try to separate the impact of institutions in relation to the effect of other factors.

A framework that relates structure and performance, and which has been the traditional approach in industrial organization for years, is the Structure-Conduct-Performance paradigm (SCP), which assumes a stable, causal relationship between the structure of an industry, the firm conduct, and market performance (Lipczynski et al , 2005).

Costa (1996) applied the structure – conduct – performance paradigm to organisation change in urban public transport in Western Europe, identifying emerging organizational models and testing them against certain conduct (management strategy, pricing goals, objectives and procedures) and performance (productive and allocative efficiency, technological progress) elements.

Although this paradigm is market-oriented, and it has received criticism against statistics-based New Empirical Industrial Organization (NEIO) (e.g. efficient structure hypothesis) we consider that, as a conceptual/cognitive framework, it could also be extended to the public, as well as public/private realm. In such a case, special consideration should be given to the causal relationships, the existence, type and interaction (feedback etc) of which need to be carefully studied, possibly through NEIO tools[8]. Thus, in this context and building upon previous work on institutions, as reviewed in the previous paragraphs, we propose a conceptual framework for institutional performance (Figure 3), primarily having in mind the transportation industry, but with generalization perspectives to other areas and industries.

[7] A regime is a distinct set of institutions combined into a whole, according to an institutional logic that makes sense (March and Olsen, 1989)

[8] Such an example is Gasmi et al´s (2009) study between the quality of political and economic institutions and the performance of telecommunication network industry reform process in developing countries, using econometric analysis tools to explore Ganger-causality of parameters such as regulation, governance, accountability, output, efficiency, prices etc .

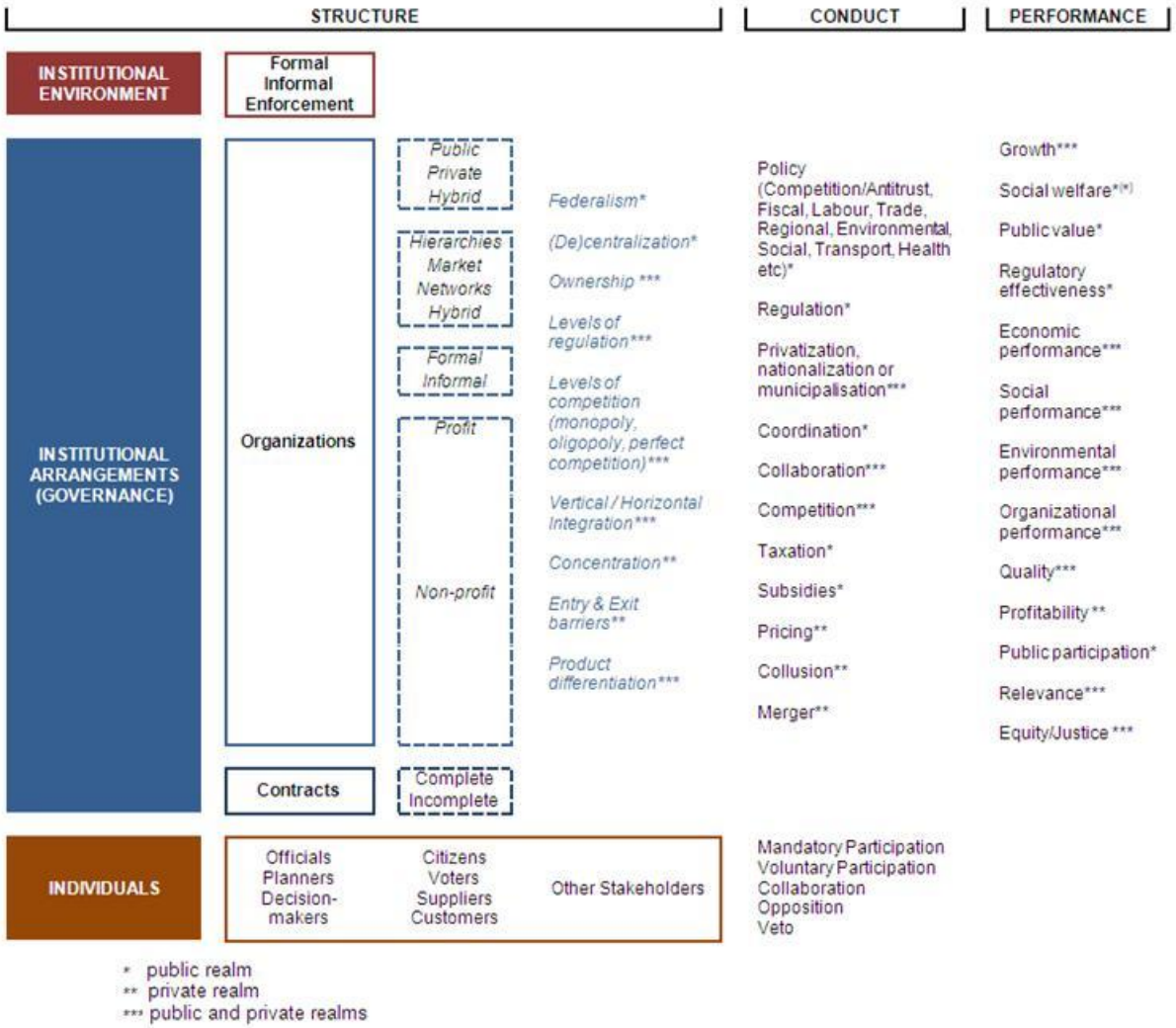

Figure 3: Conceptual framework for institutional performance analysis based on the Structure-Conduct-Performance paradigm (source: authors)

Thus, having delineated a structured base on institutional settings, the remainder of the paper will provide a review of the institutional, regulatory and organizational reform that urban public transport systems have undergone and then position the funding and financing context, as well as the relevant barriers/constraints/drivers in the institutional-performance framework.

CHANGE IN PUBLIC TRANSPORT SYSTEMS

Many public transport systems have, more or less radically, changed their organizational and financial structure, mainly on the basis of tackling improper monopolistic behaviour and unsustainable operation of the system, from an environmental, economic and social point of view. The way public transport is organized varies considerably from country to country, and even from city to city. Numerous aspects come into play: the way national and local authorities divide regulatory powers upon public transport, the way public transport financing is organized, the ownership and structure of transport operators, the nature of the relationship between authorities and transport operators, the way to establish this

relationship, the possible usage of competitive mechanisms as part of a regulatory regime, etc (van de Velde et al, 2008).

Van de Velde (1999) and TIS.PT et al (2003, MARETOPE) differentiate systems according to the initiative of organizing and supplying public transport services (i.e. authority or market initiative) and the level of regulation (regulated or deregulated), while Zografos et al (2004) developed a more disaggregated framework based on nine criteria; degree of centralization, degree of participation and consultation, degree of coordination across modes, degree of interest group influence, conflict resolution philosophy, degree of regulatory intervention, effective knowledge management and information availability for policy support, degree of quantification of policy objectives and targets, incorporation of feedback and evaluation mechanisms.

Despite the differences in public transport systems worldwide, there are common drivers for future development, which directly or indirectly led to this reform. Aging population, changing lifestyles and individualization, social exclusion, limited public funding, advancing information and communication technologies, urban sprawl, environmental degradation, just to name a few, have set a number of challenges that the evolution of public transport system should take into account. According to Rogge (2003) some of these challenges are:

- Developing flexible and customer-oriented public transport services.
- Providing integrated mobility services instead of “isolated” public transport products.
- Making the use of public transport as simple as possible.
- Strengthening the political support for public transport.
- Achieving a more balanced use of urban space.
- Supporting the development of a more comprehensive regional mobility planning approach.

In practice all these concepts have been perceived differently by various national and/or local governments, resulting in different location- and mode-specific strategies, but the main pillars of reform can be identified as the enhancement of competition, decentralization, value for public money, private sector involvement and customer-oriented development.

In Europe, the basic public transport reform directions were the introduction of competition through tendering processes and contracting, in the light of European Regulation (EC) 1370/2007 on Public Service Obligations (van de Velde, 2008). Furthermore, from an institutional perspective many other reform strategies can be found in the extensive literature on this subject, such as e.g. creation of Transport Authorities (e.g. Lisbon and Porto Metropolitan Public Transport Authorities (Nelson, 2008)), joint reform of local administrative and public transport system (e.g. Copenhagen local government reform (Viegas and Macário, 2007)) etc.

In the USA, reform was focused more on the funding and financing system in terms of decentralization (i.e. less federal funding) and flexibility (i.e. permitting the use of highway funds in some non-highway capital projects), identifying the particularities of metropolitan

areas (tackled through the creation of Metropolitan Planning Organizations). The main legal guide is the Safe, Accountable, Flexible and Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) of 2005, but although public transport operation funding and financing gain more attention, investments still remain infrastructure-focused (Hess and Lombardi, 2005).

Furthermore, international literature provides various examples of worldwide public transport reforms, such as voluntary binding partnerships of municipalities in Brazil (Viegas and Macário, 2007), New Zealand´s Land Transport Fund (Macário, 2006) etc. Nevertheless, an issue that to our knowledge has not been given the appropriate attention is the spatial aspect of such reforms. Macário (2006) notices that "as the size and shape of urban areas developed and spread across peri-urban areas, forcing the mobility network configuration to lose its original radial shape and to extend beyond the administrative borders of the city, the need to extend the scope of intervention of the mobility authority to all communities with a direct stake in the mobility system becomes more obvious". Three issues must be taken into account in order to obtain an efficient territorial definition: the systemic reality; the need to compare and transfer solutions; and the financial manageability of the system (Macário, 2005; 2006).

Barriers and constraints to public transport reform

Before delving into the financial barriers and constraints of the transport systems, in general, and the public transport system, in particular, we provide some working definitions of these terms since different use by various authors causes certain confusion.

According to Rouwendal et al (2003) a 'barrier' is a, typically exogenous, factor that limits the regulator's ability to implement the most desired policy and a barrier is relevant when it causes a 'constraint' on the policy options. Barriers and constraints are therefore no synonyms, but in fact there is a causal relation between them. As a result, a certain barrier may cause multiple constraints; and a certain constraint may result from multiple barriers. According to May et al (2004), a constraint is a specific restriction imposed on a policy instrument, such as e.g. maximum fare levels.

Rouwendal and Verhoef (2006), provide a good explanation on this subject. A certain constraint may thus indeed result from different barriers (e.g. the inability to differentiate prices by time of day may result from technical limitations or from social opposition), in which case it may take the removal of multiple barriers to loosen a constraint. At the same time, a single barrier may cause multiple constraints (e.g. social acceptability may limit both the maximum toll levels that can be applied in a democracy, and the possible revenue allocations that pass the democratic test), in which case the removal of a certain barrier may loosen multiple constraints.

Several background studies have exhaustively identified and assessed the transport-related barriers and constraints for different types of cities (Crain & Associates, Inc., Pacific Consulting Group, 1996; Rietveld and Stough, 2005; TIS.PT, 2003 (MARETOPE); May et al,

2006; METEOR, 2006; Rayle, 2008), but the lack of a comprehensive framework of their interrelations and contextual influences was not found in the literature. Thus, building upon previous work, we identified two main blocks of barriers, organizational and behavioural / social / cultural, which are further divided into a number of subcategories, as presented in Figure 4. Organization of the transport system is structurally based on institutions (as defined previously) and resources that support them. Institutions are characterized by their legal and regulatory framework, as well as their governance structures, which in turn are also connected to the legal and regulatory framework. Resources, tangible and intangible, constitute a barrier on the basis of their lack or improper use, such as the case of financial resources that we are analyzing in this paper. Furthermore, the transport system is affected by the behavioural, social and cultural background of its various actors (or stakeholders, or agents), which according to their ability to influence decision-making, they accept, promote, cooperate, participate and learn from one another, or not, causing in the latter case barriers to the implementation of decisions, objectives, strategies, as well as policy measures.

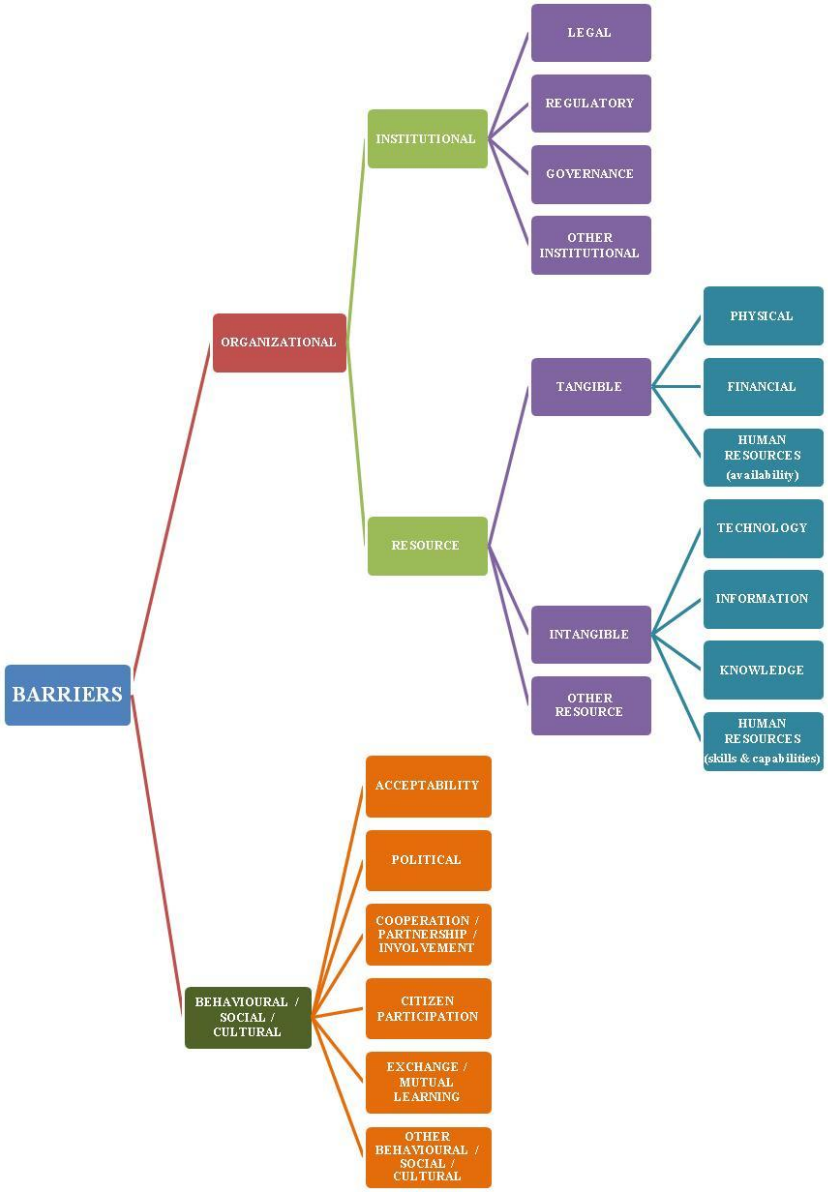

Figure 4: Barrier classification and interrelations (source: authors)

FUNDING AND FINANCING IN PUBLIC TRANSPORT

Perhaps no area of transportation policy generates as much contention, raises as many questions, or has been the subject of so many intense policy debates as the financing of the system. However, despite the attention, the debates and discussion around transportation finance are rather esoteric and often get caught up in larger conversations about taxes, economic growth, and equity (Katz and Puentes, 2005). In the following paragraphs we will clarify some important concepts of this topic, present the basic funding/financing mechanisms and discuss over their problems, weaknesses and strengths.

Funding and financing

Funding and financing are terms that are interchangeably used in the international literature to denote the financial means used for the implementation of a project or the provision of a service. According to Harriman's Financial Dictionary (Briscoe and Fuller, 2007) a fund is defined as “a pool of money normally set apart for a purpose, for example, a pension fund to provide pensions”. A similar definition is provided by Merriam-Webster dictionary (2003), where fund is “a sum of money or other resources whose principal or interest is set apart for a specific objective”.

According to AASHTO, funding refers to different revenue sources generated at the Federal, state and local levels used for transportation investment needs, including taxes, fees, user charges, and capturing enhanced property values, while financing refers to different financial tools that are used to leverage transportation funding and revenue sources, allowing transportation agencies to raise the high up-front costs needed to build projects and expedite the implementation of needed transportation improvements. “Finance mechanisms are the tools used to expand upon existing funding sources at any given time; they include a wide variety of bond-backed by different types of revenue streams, together with credit enhancement and revolving loan programs designed to assist transportation agencies in expediting the implementation of transportation improvement” (ibid).

The major funding and financing issues in transportation focus on ensuring the pecuniary resources and applying the appropriate financial models that facilitate the implementation of transport policy objectives, translated into actions and projects. Thus, in order to cover capital (for infrastructure and equipment - e.g. rolling stock, fleet etc), as well as operations (for service provision, infrastructure operation, and other services – e.g. maintenance etc) expenses of the (public) transport system, we identified the following sources:

- *Public funding*, defined as public equity money pool, generated from national or local government revenues, on a dedicated/earmarked or general budget basis, managed and allocated by a public body, so as to serve a specific objective, e.g. subsidies, reimbursements, payments, infrastructure/equipment capital etc.

- *Public financing*, defined as public equity money provided as debt obligation to another public or private party, with or without future revenue commitment e.g. public loans, bonds etc.
- *Private funding*, defined as private equity money provided by a private party for a specific purpose, e.g. private equity for infrastructure project financing, user fees for using a service (e.g. fares) or an infrastructure (e.g. tolls) etc.
- *Private financing*, defined as private money allocated as debt obligation by a private party to another private or public party, for a specific purpose, usually, but not restrictively, in order to supplement funding gaps e.g. loans from private financial institutions etc.
- *Public-Private financing*, defined as a hybrid financial model that makes use of all or partial combinations of public and private money (in the form of equity and/or debt).

Nevertheless, it has to be noted that the classification of financial flows is not a clear-cut task, since they can belong to more than one of these categories, depending on the specific perspective of analysis. For example, public transport user fees can be considered a private fund that constitutes a revenue source for the public authority, which at a later point uses that money as public funds allocated to a transport or non-transport related purpose.

Funding and financing of services and infrastructure

A representation of funding and financing flows among system actors for service and infrastructure provision is presented in Figure 5. Due to the inherent complexity of the Public Private Partnership (PPP) schemes for infrastructure provision, a detailed presentation of the financing mechanisms is not possible in the framework of this paper and the reader is prompted to the vast literature on this topic, but for reasons of completion we provide in Table I a comparative overview of conventional procurement and PPP models.

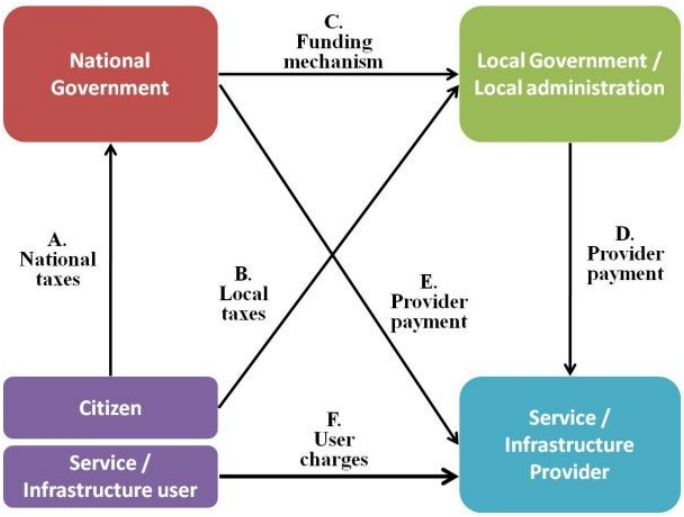

Figure 5: Financial flows among actors (based on Smith, 2006)

Table I: Responsibility matrix for conventional procurement and PPP options (PPIAF and World Bank, 2009)

			Public – Private Partnership				
	Works and Service Contracts (conventional procurement)		**Management and maintenance contracts**		**Operation and Management Concessions**	**Build – Operate – Transfer Concessions**	**Privatiza-tion**
Type	**Design, Bid, Build**	**Design, Build**	**Manage-ment contracts**	**Performa nce - based contracts**	**Lease or Franchise or Affermage Brownfield**	**BOT/DBFO/BO O Greenfield**	
Design	Private by fee contract	Private by fee contract				Private by concession contract	Private
Build	Private by fee contract						
Operation & Mainte-nance	Public	Public	Private by fee contract	Private by Perfor-mance-based contract (PBC)	Private by concessio n contract		
Finance	Public	Public	Public	Public			
Own	Public	Public	Public	Public	Public	Public after contract (BOT/DBFO) or Private (BOO)	
Private Sector Revenue Options				Tolls (concession models)			
				Availability Payments* (PFI model)			
				Government guarantees and support Other support (e.g. insurance)			

** Periodic payment made to a concessionaire by a public authority for providing an available facility. Payments are reduced if the facility is not available for a period of time, or not being maintained in satisfactory condition (FHWA, 2008)*

Public transport funding and financing mechanisms

A comprehensive typology of funding and financing instruments for public transport is presented in the TCRP Report 129 (Jenks et al, 2009), but although they are USA-specific, the majority of these are applied to other countries as well. The classification is the following:

- *Traditional tax- and fee-based transit funding sources* (e.g. General Revenues, Sales Taxes, Property Taxes, Contract or Purchase-of-Service Revenues, Lease Revenues, Vehicle Fees, Advertising Revenues, Concessions revenues).
- *Common business, activity, and related funding sources* (Employer/Payroll Taxes, Car Rental Fees, Vehicle Lease Fees, Parking Fees, Realty Transfer Taxes/Mortgage Recording Fees, Corporate Franchise Taxes, Room/Occupancy Taxes, Business License Fees, Utility Fees/Taxes, Income Taxes, Donations, Other Business Taxes).
- *Revenue streams from projects* (Transit-Oriented Development/Joint Development Value Capture/Beneficiary Charges, Special Assessment Districts, Community Improvement Districts/Community Facilities Districts, Impact Fees, Tax-Increment Financing Districts, Right-of-Way Leasing).

- *New "User" or "Market-Based" Funding Sources* (Tolling, Congestion Pricing, Emissions Fees, VMT Fees).
- *Financing Mechanisms* (General Obligation (GO) Bonds, Private Activity Bonds (PABs), Tax Credit Bonds, Grant Anticipation Notes (GANs), Grant Anticipation Revenue Vehicles (GARVEEs), Revenue Anticipation Notes (RANs), Certificates of Participation (COPs), State Infrastructure Bank (SIB) loans).

In many urban areas, existing financing mechanisms typically rely solely on a combination of user charges and public budgets, and do not provide sufficient funding for a sustainable transport policy. Furthermore, cross funding of public transport from private money is expected to become an even more important source of funding in the future as technology advances (e.g. sophisticated road pricing or fare collection schemes), while special consideration should be given to the implementation of new and innovative funding and financing instruments (TIS.PT, 2001, FISCUS).

Another crucial element of a public funding system is the allocation of funds from the central (national, federal etc) government to the local administration bodies (state, regional, municipal, etc), as well as the central or local government to the service provider (Flows C, D and E in Figure 5). Smith (2006) identified the following types of funding mechanisms, but he argues that in practice, most systems of funding/financing local public service institutions use a mix of all types:

- Based on *political patronage.*
- According to *historical precedent.*
- According to *bids* submitted by localities or allocations contingent on some *measure of local performance*.
- According to how much localities *actually spend.*
- Allocation by *mathematical formula.*

It is worth discussing further on these mechanisms because in cases of total dependence on the central budget, the inefficient function of this part of the system creates significant barriers and constraints. *Political patronage* refers to rewarding localities according to their political support in the past, or their importance for future elections (Smith, 2006), but this aspect, although easily observed, cannot be verified in the framework of a study or formal analysis. Furthermore, *historical precedent* seems more of an outdated practice that, if still applied, cannot survive due to the extended public sector reform aiming at value for public money and transparency. *Local authority bids* and *performance budgeting*, if undertaken properly, could ensure that public funds are spent in line with national policy intentions, in a cost-effective manner, but involves large transaction costs (central scrutiny and policing, preparation of bids by local authorities) and makes local budgets contingent on the quality of local management, leading perhaps to large geographical inequalities (ibid). As far as *spending precedent* is concerned, it is considered that it contradicts principles of good public finance, as it is likely to encourage spending in excess of efficient levels (ibid).

Smith (2006) also suggests that formula funding is the desire of national and local government payers, to limit the magnitude of aggregate expenditure, to share that limited expenditure in an optimal fashion, to transmit objectives to devolved entities and to give them appropriate incentives. In this case, the local entity (local government or service provider) is reimbursed either on the basis of some measure of local activity, typically a count of the number of service users, or according to the expected level of local activity (i.e. expected level of local service expenditure), without reference to actual local service use.

There are many reasons used to justify *subsidy* for local public transport infrastructure, fares and service levels, based mainly on economic grounds (primarily efficiency and equity), political realities (including the power of interest groups), and what is called the social role of public transport (Berechman, 1993). Ubbels et al (2004) distinguish between provider-side subsidies and user-side subsidies. The former involve financial support for the provider of the public transport service, for example covering the deficits of a company or providing support in the light of a certain tariff structure or a certain quality of service. A subsidy can also depend on the performance, while in other cases it is not that explicit, such as tax exemptions. User-side subsidies are less common and involve direct benefits to the user/traveller (e.g. particular societal groups), or tax allowances (e.g. public transport costs being an allowable income tax deduction for commuting), while the operator receives the subsidy only when the traveler makes use of its services (ibid).

Special attention should be given to the implementation of funding and financing instruments in a combined (packages) and integrated way, but adaptation to the specific territorial, institutional and financial local environment is important. TIS.PT et al (2001) in FISCUS project proposed the packaging of funding and financing schemes, as presented in Table II.

Debate among scholars has been caused regarding the benefits or disbenefits of dedicated or earmarked revenue streams (Hess and Lombardi, 2005; Ubbels et al, 2004). Despite the security offered by dedicated funding from a reliable source, Wachs (2003) argues that the combination of increasing dependence on broad-based taxes that are not directly linked to transportation, such as local sales taxes, as well as the declining reliance on user fees, such as fuel taxes and tolls, result in a funding environment that is inequitable and inefficient. Although highway user fees have the potential to affect personal transportation choices, sales or income taxes are unlikely to influence individual travel behaviours (Pickrell, 1992). On the contrary, Pickrell (1992) argues that competing for general revenue funds with other public services and not relying on a guaranteed, recurring source of funding, ensures that decisions on public transport expenditures and particularly capital investments, are responsible and cost-effective. From an empirical point of view, Hess and Lombardi (2005) observed that dedicated sources of funding are becoming an increasingly important in subsidizing public transport, particularly in the context of a decentralized public transport funding system.

Table II: Example of possible funding and financing instruments packaging based on local-sensitive characteristics (based on TIS.PT (2001), FISCUS, and modified by the authors)

City size	City characteristics				Financial Position		Possible Packages
	Severe environmental problems		Capital intensive public transport				
	Yes	No	High/low	Low	Strong	Weak	
Very large/large	√		√		√		Public sector self-financing
	√		√			√	Public/private partnership, full commercialization
		√	√		√		Public sector with subsidies
		√	√			√	Public sector with additional User/beneficiaries charges, Public/private partnerships, Full commercialization
Small/medium	√			√	√		Public sector self-financing
	√			√		√	Self-financing & additional User/beneficiaries charges to serve Self-financing, private finance
		√		√	√		Public sector with subsidies
		√		√		√	Public sector with additional User/beneficiaries charges Public/private partnerships, full commercialization

Financial barriers and their implications

Financial barriers can take various forms, most common of which are *budgetary restrictions* limiting the overall expenditure on a public transport strategy (either transport infrastructure or service). These restrictions stem primarily from the *scarcity of public money*, which has led to a value-management approach on behalf of the system´s decision-makers, translated in practice into public agencies having to *compete for public funds* and more active *involvement of the private sector*, in terms of private funding and financing (e.g. PPPs, outsourcing, secondary business activities - advertising, fleet renting - etc). The former constitutes a positive development towards effective use of public money on projects and investments that are highly prioritized from a cost-benefit point of view on the one hand, but entails *high transactions costs* and skilful personnel requirements on the other. Nonetheless, a highly competitive environment might create *conflicts of interest* among public sector stakeholders, *jeopardizing trustful relationships* and thus posing *barriers to cooperative governance* and *integration*. It has also to be mentioned that budgetary constraints (in the form perhaps of an expenditure threshold) in the framework of a carefully planned investment and funding allocation plan is more than necessary so as to ensure the effective and efficient use of the available funds on behalf of the managing authorities.

Another financial barrier is the *rigidity*, *uncertainty* and *complexity* of funding and financing systems. In practical terms, a highly complex and compete-for-funds system requires a great number of human resources to monitor and bid for the various calls, fund types and authorities. Furthermore, funding pools dedicated to specific transport-related purposes entail advantages that have been discussed previously, but they should also show a relative *flexibility* in being used for other transport mode projects, when the local conditions and

needs demand for this. Indeed, USA´s reformed transport funding and financing system allows for the dedication of portions of federal and state highway user fee revenues to transit (Committee for the Study et al, 2006). Finally, uncertainty of funding and financing sources, doesn´t allow for long-term financial planning of projects, investments and schemes. Another barrier that deteriorates this situation is the so-called "*Capital-Rich, Revenue Poor*" mismatch (Binsted and Brannigan, 2008a), which means that the availability of capital can be sufficient to fund transport and land-use projects, although there can be issues over how the operation, servicing and maintenance of these capital assets will be funded. For reasons such as this, as well us scarcity of public funds, alternative / innovative forms of funding and financing are called upon to provide with revenue solutions.

Decentralization has been the central element of public transport reform in many countries, but the results have not reached the expectations, primarily because the *devolution of responsibilities was not accompanied by the allocation of relevant financial autonomy* to implement the decisions taken. Even in cases that no conflicts between central and decentralized authorities exist, the *bureaucratic structure* of intergovernmental financial flows process, as well the existence of political motivations that sometimes *channel funding resources towards other non-transport projects* (Binsted and Brannigan, 2008a), diminish the full spectrum of benefits of the original reform.

Finally, *low acceptability* on behalf of the citizens and their *low willingness to pay* new taxes or transport-related fees, creates barriers to the *expansion of the funding and financing tools* and consequently increase of revenues. The opposition is greater in the light of imposing fees on a previously free service, especially when it is considered to be a public good, like transportation, while this environment of discontentment, deters the politicians from proceeding into the implementation of such measures.

It is evident from the previous analysis that financial barriers and constraints cannot be analyzed as units, but are embedded in an overall barrier framework, interrelating with other aspects of the public transport system. Towards this direction, Binsted and Brannigan (2008b) identified a number of financially-derived barriers, such as organizational constraints of lack of staff time and resources, high levels of funding uncertainty, constraints of narrow leadership interests and political will, technical capabilities of tools and officers, effective management of partnerships, 'capital-rich revenue-poor' mismatch, management of the potentially adverse impacts upon local transport priorities of funding streams related to funding bodies and difficulties relating to funding 'soft' transport schemes. They also identified the negative implications of these barriers to the progress of various schemes (Table III).

Table III: Implications of funding mechanisms on scheme progress (Binsted and Brannigan, 2008b)

Elements of funding mechanisms \ scheme progress	**Scheme implementation failure**	**Type of scheme implemented**	**Alteration of scheme details**	**Reduced investment cost effectiveness**	**Delays to scheme delivery**	**Scheme cost increase**
Amount of detail required in the production of bids					√	
Constraints imposed on how resources from some sources can be spent		√	√	√		
Constraints imposed on when resources can be spent				√		
Cost increases			√		√	
Delays to delivery						√
Difficulty in quantifying scheme benefits	√	√				
Funding criteria			√			
Inadequate planning					√	√
Lack of advance funding						√
Lack of political will	√	√	√			
Lack of suitably skilled staff	√				√	√
Necessity to meet funding stream bidding criteria	√	√	√	√		√
Phasing of funding provision		√	√		√	√
Relatively poor availability of revenue funding;	√	√	√	√	√	√
Scheme delay			√			
The partnership working process			√		√	√
Uncertainty of developer contributions		√	√	√	√	
Uncertainty of the bidding process	√				√	
Uncertainty over long term allocation and availability of resources				√		

CONCLUSIONS

We need to understand institutions in order to improve their performance over time (North 2005; Ostrom 2005). Towards this direction, this paper presented a structured analysis of institutional design and funding and financing issues in the public transport sector, combining evidence from literature sources[9]. As a result, we conclude that funding and financing are

[9] Complemented by research work developed by the authors in the Framework of the MIT Portugal research program on urban mobility, encompassing the following projects: SOTUR (Strategic Options for Integrating Transportation Innovations and Urban Revitalization); SCUSSE (Smart Combination of passenger transport

critical elements of the system, directly influenced by the institutional settings and their reforms, which at the same time influence back the institutional arrangements they are embedded in. That is, they are simultaneously a result of a given institutional set and the cause of some performance (or misperformance) aspects of the mobility system.

Thus, public transport funding and financing require a sound institutional environment, along with appropriate institutional arrangements, that operationalize efficiently and effectively these monetary streams (value for money), so as to achieve the desired policy goals and objectives. Moreover, funding- and financing-derived barriers and constraints affect not only the operation of the public transport network, but the performance of the responsible institutional arrangements as well, with further implications to the overall system performance. There is no universal best funding and financing configuration for public transport systems, but identifying difficulties, future trends and taking account the local context provide a satisfactory base framework for successful strategies (Viegas and Macário, 1998; 2001), meaning that funding and financing can not be assessed or decided independently from the institutional framework constraining the system; a systemic assessment towards best fitting solution is required.

Furthermore, special consideration should be given to the promising practice of funding and financing control as a performance driver, as for example in the context of performance budgeting. Finally, our recommendations for further research, in relevance to the topics addressed in this paper, relate to the analysis of the existing public transport systems, through the spectrum of the theoretical framework suggested in this paper, aiming at the identification of causal relationships among the structure, conduct and performance of these systems. In this context, the multifaceted implications of funding/financing should be considered in three levels; as a structural element of the system, as possible sources of barriers and constraints, as well as policy tools *per se* to improve the overall performance of the public transport system.

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